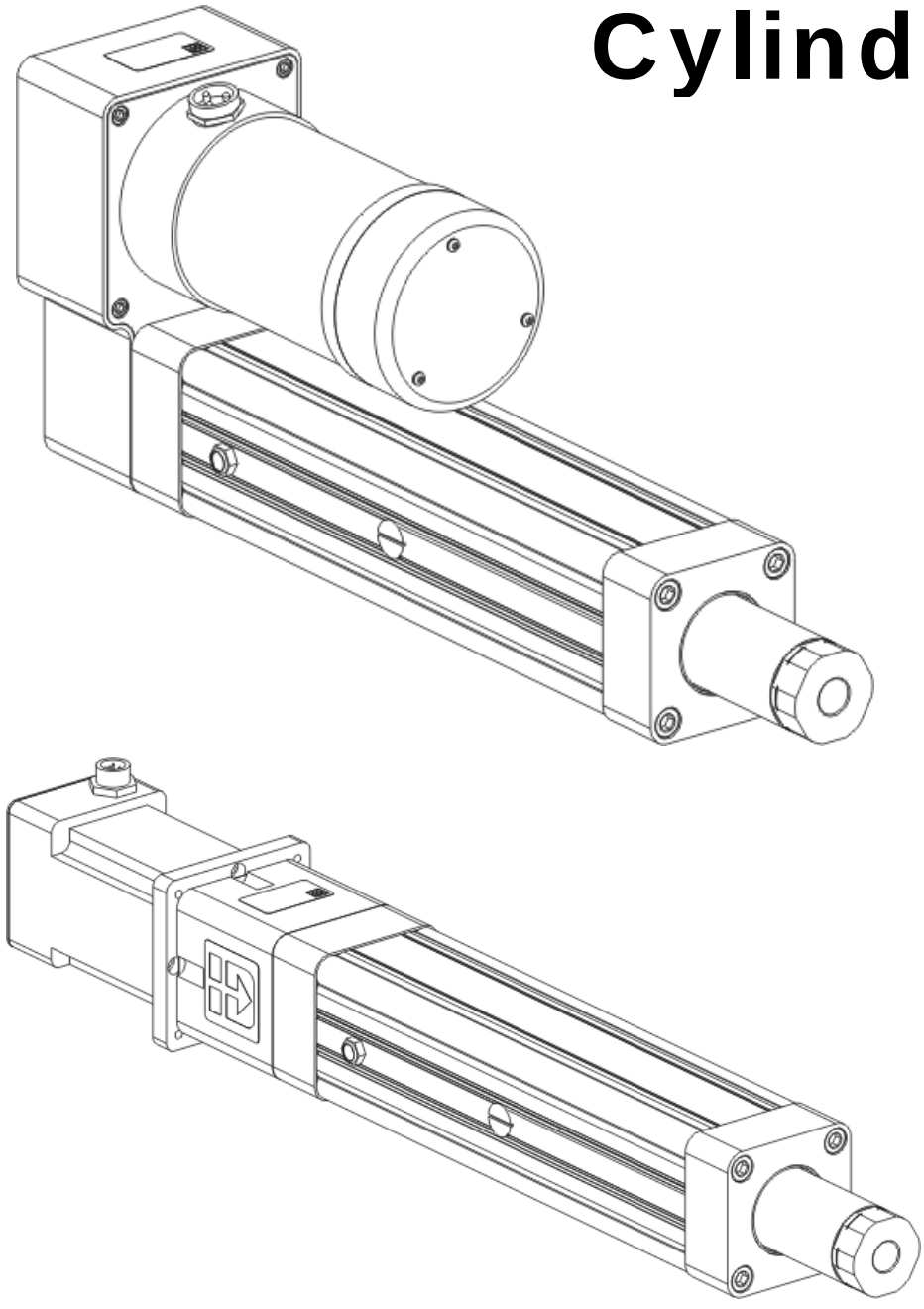
INDUSTRIAL
DEVICES
CORPORATION

EC Series Electric Cylinders



User's Manual

P/N CUS10050 Version 1.0

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1. Product Overview

Industrial Devices Corporation's EC Series Electric Cylinders are designed for use in a wide variety of industrial, scientific, and commercial applications requiring precise control of linear thrust, speed, or position. This manual will help you install, operate, and maintain your EC Series Cylinder.

EC Series Features

From the EC2 to the EC5, the EC series is IDC's highest performance line of electric cylinders. Following are several features that make the EC the cylinder of choice for the most demanding applications:

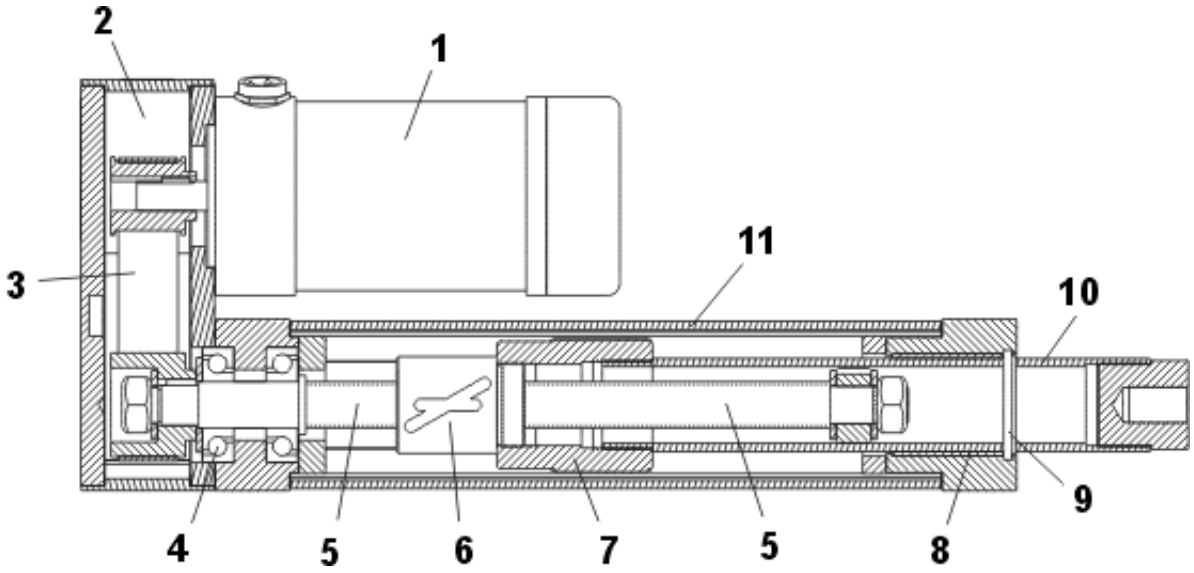
- **Robust design for highest loads and longest life possible**
- **Precision rolled ballscrews for smoothness and accuracy**
- **Environmentally sealed -** All standard versions of EC cylinders are IP54 rated. An IP65-rated, Protective Boot (-PB) option is available on all EC cylinders. This optional thrust tube boot prevents moisture and dry contaminants from bypassing the thrust tube wiper seal.
- **Metric dimensions in accordance with ISO6431** - Meets the needs of customers who manufacture for the international marketplace. Both English and Metric versions of threaded mounting options are standard.
- **ACME screws available** on the EC2 and EC3 versions.

EC Series Specifications

Specifications vary for the four basic EC configurations (EC2, EC3, EC4, EC5). Please refer to Section 3, *EC Series Specification and Configuration Reference* for specification parameters and configurations.

EC Electric Cylinder Construction (Typical)

This cross-section of an EC4 cylinder, with parallel motor mounting, is provided to illustrate the typical components of an IDC electric cylinder. Refer to Section 10, *Parts List and Exploded Parts Diagrams*, for a more detailed breakdown of EC cylinders.



1. Motor (may be customer supplied)
2. Drive Housing
3. Drive Train (belt drive shown)
4. Thrust Bearings
5. Leadscrew
6. Drive Nut
7. Internal Guide Flange (including magnets)
8. Rod End Bearing
9. Rod End Wiper
10. Thrust Tube
11. Guide Cylinder

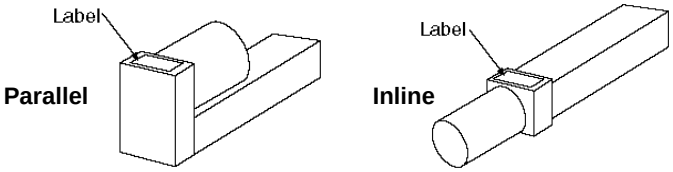
2. Cylinder Part Numbers - Identifying a Cylinder

Your new EC cylinder will arrive with an IDC factory label attached as shown below. The factory label provides a detailed breakdown of the cylinder model with all of its mechanical characteristics. This section can be used to: 1) identify a cylinder's mechanical characteristics based on the factory label, or 2) order a new EC cylinder with different mechanical characteristics.

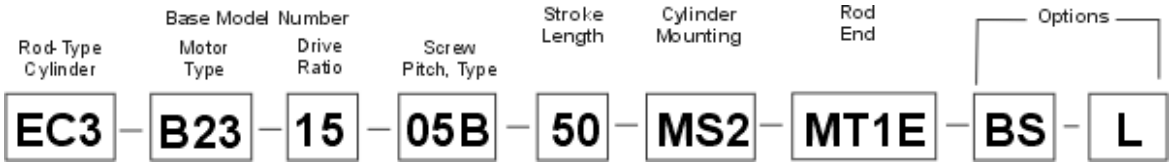
Label Location

Industrial Devices Corp.
3925 Cypress Dr, Petaluma, CA 94954
800-747-0084 Fax: 707-789-0175
Electric Cylinder Model:
EC3-P32-16-06B-60-M32-MT1E-B8-L
Serial Number: XXXXX XXXX XXX
Voltage: XXX V Rated Current: XX A

Locations of Labels on Different Motor-Mounting Configurations



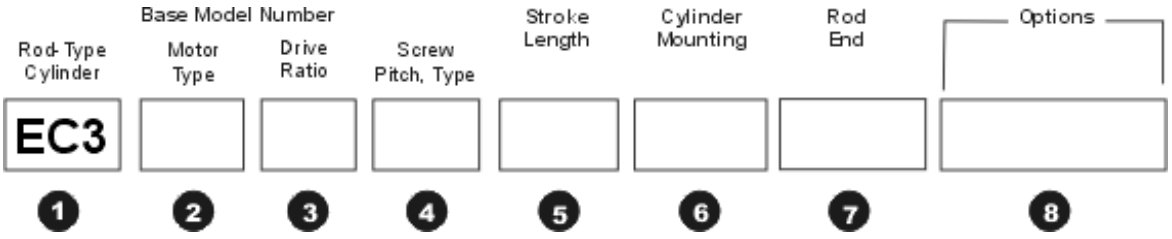
Model Number Example



EC3 = Product Series
B23 = NEMA 23 Frame, Brushless Servo Motor
15 = 1.5 to 1 Drive Ratio - Belt/Pulley
05B = 5 mm Lead Ballscrew
50 = 50-inch stroke
MS2 = Side Lugs Mounting
MT1E = Male Threaded Rod End - English Threads
BS = Brake on Screw Option
L = Linear Potentiometer Option

Identify Your EC Cylinder Using the Cylinder Configuration Guide

This fill-in-the-box section is provided for users who want to identify an existing EC cylinder or perhaps order a new EC cylinder. To identify the mechanical characteristics of an existing EC cylinder, photocopy this page and transcribe the model number from the factory label to boxes 2 through 8. To reconfigure or order a new EC, fill in boxes 2 - 8 with codes for the new cylinder. Refer to the **Cylinder Configuration Guide** on the following pages for boxes 2 - 8. See IDC's latest catalog or website (www.idcmotion.com) for more information.



Cylinder Configuration Guide

2 Motor Type

D	24VDC, 4.5 Amp, Permanent Magnet Motor
H	160VDC, 2 Amp, Permanent Magnet Motor
H4	160VDC, 5 Amp, Permanent Magnet Motor
P22[**x*]	NEMA 23 Frame, Step Motor, 3 Stack
P32[**x*]	NEMA 34 Frame, Step Motor, 2 Stack
S32[**x*]	NEMA 34 Frame, Step Motor, 2 Stack
S42[**x*]	NEMA 42 Frame, Step Motor, 2 Stack
B23	NEMA 23 Frame Brushless Servo Motor
B32	NEMA 34 Frame, Brushless Servo Motor
B41	NEMA 42 Frame, Brushless Servo Motor
X	Customer-Supplied Motor (motor described in "Options" element of part number)

***Insert one of the following codes for *X*:**

N = 8 leads (windings can be wired in Series or Parallel)
T = Pre-wired in Series
V = Pre-wired in Parallel

3 Drive Ratio

10	1.0:1 Drive Belt/Pulley	*(1.0:1 exact ratio)*
15	1.5:1 Drive Belt/Pulley	*(1.5:1 exact ratio)*
20	2.0:1 Drive Belt/Pulley	*(2.0:1 exact ratio)*
50	5.0:1 Drive Belt/Pulley	*(5.0:1 ratio)*
***70**	7.0:1 Drive Belt/Pulley	*(7.0:1 ratio)*
100	10.0:1 Helical Gear	*(10.1 exact ratio)*
10L	1.0:1 Inline Coupling	(Direct 1:1 coupling is the only ratio available for Inline Models)
*EC3 only		

4 Screw Type

04A	4 mm/rev ACME leadscrew
05B	5 mm/rev ballscrew
10B	10 mm/rev ballscrew
16B	16 mm/rev ballscrew
25B	25 mm/rev ballscrew
32B	32 mm/rev ballscrew

5 Stroke Length

Specified in Millimeters

Cylinder Configuration Guide

6 Mounting Styles

MF1 **MF2** **MF3**	Front Rectangular Flange Rear Rectangular Flange Front & Rear Rectangular Flange	
MP2 **MP3**	Rear Double Clevis Mount (shown) Rear Double Clevis Mount with Pivot Base	
MS1	Side End Angles	
MS2	Side Lugs	
MS6M **MS6E**	Side Tapped Mounting Holes	
MT4	Trunnion Mount	

7 Rod Ends

FC2	Clevis (includes MT1M)	
FS2	Spherical Joint (includes FT1M)	
FT1M **FT1E**	Female Thread	
MT1M **MT1E**	Male Thread	
Note: Rod-End dimensions can be found in the latest IDC Catalog or on our website *www.idcmotion.com*		

8 Cylinder Options

BM[*x]	Brake on Motor
BS[*x]	Brake on Leadscrew
EMK	Encoder on Motor (1000 line)
L	Linear Potentiometer
LR	Linear Rod Bearing (EC2 only)
PB	Protective Boot
Motor Mod Codes for X Motors (customer supplied) also found in "option part" of Part Number	

***Insert one of the following codes for *X*:**

24 = 24 VDC Brake
115 = 115 VAC Brake
230 = 230 VAC Brake

3. EC Series Specification and Configuration Reference

EC2 - Specifications				
Parameter	**EC2-D**	**EC2-H**	**EC2-S32/P22**	**EC2-B23**
Motor Type	24 VDC Brushed	160 VDC Brushed	1.8° Hybrid Stepper	Brushless Servo
Max Load Capacity N [lbs]	3230 [740]	3600 [810]		
Max No Load Speed mm/s [in/s]	840 [33]	930 [36.5]	800 [31.5]	1280 [50.5]
Repeatability mm [in]	±0.13 [±0.005]	±0.013 [±0.0005]		
Compatible IDC Controls	D2200 D2300 D2400 D2500B	H3301B H3321B H3501	NextStep SmartStep S6002 S6961 S6962	B8001 B8961 B8962
Performance Curves	*See Latest IDC Catalog or www.idcmotion.com*			
Configurations and Options Available - ***See "Cylinder Configuration Guide" for explanation of codes below***				
Drive Ratio	10, 15, 20, 50, 100, 10L			
Screw Type	04A, 05B, 16B			
Stroke Length mm	50, 100, 150, 200, 250, 300, 450, 600, 750; Custom lengths available in 1 mm increments			
Cylinder Mounting	MF1, MF2, MF3, MS1, MS2, MP2, MP3, MS6M, MS6E, MT4			
Rod End	FT1M, FT1E, MT1M, MT1E, FC2, FS2			
Options	-BS, -EMK, -L, -LR, -PB	-BM, -BS, -EMK, -L, -LR, -PB	-BS, -EMK, -L, -LR, -PB	-BM, -BS, -L, -LR, -PB

EC3 - Specifications			
Parameter	**EC3-H**	**EC3-P32**	**EC3-B23/B32**
Motor Type	160 VDC Brushed	1.8° Hybrid Stepper	Brushless Servo
Max Load Capacity N [lbs]	7200 [1620]		
Max No Load Speed mm/s [in/s]	930 [36.5]	800 [31.5]	1280 [50.5]
Repeatability mm [in]	±0.025 [±0.001]	±0.013 [±0.0005]	
Compatible IDC Controls	H3301B H3321B H3501	NextStep SmartStep S6002 S6961 S6962	B8001 B8961 B8962
Performance Curves	*See Latest IDC Catalog or www.idcmotion.com*		
Configurations and Options Available - ***See "Cylinder Configuration Guide" for explanation of codes***			
Drive Ratio	10, 15, 20, 50, 70, 10L		
Screw Type	04A, 05B, 10B, 16B		
Stroke Length mm	50, 100, 150, 200, 250, 300, 450, 600, 750, 1000; Custom lengths available in 1 mm increments		
Cylinder Mounting	MF1, MF2, MF3, MS1, MS2, MP2, MP3, MS6E, MT4		
Rod End	FT1M, FT1E, MT1M, MT1E, FC2, and FS2		
Options	-BM, -BS, -EMK, -L, -PB	-BS, -EMK, -L, -PB	-BM, -BS, -L, -PB

EC4 - Specifications			
Parameter	**EC4-H4**	**EC4-P32**	**EC4-B32**
Motor Type	160 VDC Servo	1.8° Hybrid Stepper	Brushless Servo
Max Load Capacity N [lbs]	12000 [2700]		
Max No Load Speed mm/s [in/s]	1330 [52.5]		
Repeatability mm [in]	±0.025 [±0.001]	±0.013 [±0.0005]	
Compatible IDC Controls	H4301B H4321B H4501	NextStep SmartStep S6002 S6961 S6962	B8001 B8961 B8962
Performance Curves	*See Latest IDC Catalog or www.idcmotion.com*		
Configurations and Options Available - ***See "Cylinder Configuration Guide" for explanation of codes***			
Drive Ratio	10, 15, 20, 50, 100, 10L		
Screw Type	10B, 25B		
Stroke Length mm	50, 100, 150, 200, 250, 300, 450, 600, 750, 1000, 1500; Custom lengths available in 1 mm increments		
Cylinder Mounting	MF1, MF2, MF3, MS2, MP2, MP3, MS6M, MS6E, MT4		
Rod End	FT1M, FT1E, MT1M, MT1E, FC2, FS2		
Options	-BM, -BS, -EMK, -L, -PB	-BS, -EMK, -L, -PB	-BM, -BS, -L, -PB

EC5 - Specifications		
Parameter	**EC5-S42**	**EC5-B32/B41**
Motor Type	1.8° Hybrid Stepper	Brushless Servo
Max Load Capacity N [lbs]	25000 [5620]	
Max No Load Speed mm/s [in/s]	1330 [52.5]	
Repeatability mm [in]	±0.013 [±0.0005]	
Compatible IDC Controls	NextStep SmartStep S6002 S6961 S6962	B8001 B8961 B8962
Performance Curves	*See Latest IDC Catalog or www.idcmotion.com*	
Configurations and Options Available - ***See "Cylinder Configuration Guide" for explanation of codes***		
Drive Ratio	10, 15, 20, 50, 100, 10L	
Screw Type	10B, 32B	
Stroke Length mm	50, 100, 150, 200, 250, 300, 450, 600, 750, 1000, 1500; Custom lengths available in 1 mm increments	
Cylinder Mounting	MF1, MF2, MF3, MS2, MP2, MP3, MS6M, MS6E, MT4	
Rod End	FT1M, FT1E, MT1M, MT1E, FC2, FS2	
Options	-BS, -EMK, -L, -PB	-BM, -BS, -L, -PB

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4. Mounting Your EC Cylinder

Warning! Ensure that **power to the electric cylinder is OFF** before attempting any installation, adjustment, or modification of the cylinder mounting, rod end attachment, or the load.

Mounting Requirements

1. **CAUTION!** When using pivot-mounting options (MP2, MP3, or MT4) with a pivot rod-end (FS2 or FC2), it is recommended that the cylinder not be extended more than 95% of its full stroke. This increases the system's rigidity and extends the life of the guide bearings and rod seal.
2. The structure on which the cylinder is mounted must be capable of holding three times (3X) the cylinder load and be rigid enough to prevent undue deflection or distortion of the cylinder or its supporting members.
3. The cylinder must be mounted parallel to the travel of the load to ensure proper alignment (this is especially important with externally guided loads using rails, bearings, etc.).
4. All mounting surfaces must be flat and clean to provide for secure and stable fittings.
5. Units with flat surface mounts (MF1, MF2, MF3, MS1, MS6) must be rigidly mounted.

Cylinder Mounting Styles

Each cylinder mounting style presents different application considerations. Find your mounting style(s) in the table below and pay special attention to the corresponding "Application Requirements" column.

Cylinder Mounting Style	Application Requirements
MF1 - Front Flange	Not recommended for use in horizontal applications with stroke lengths greater than 300 mm unless there is additional support in the rear of the cylinder.
MF2 - Rear Flange	Not recommended for use in horizontal applications with stroke lengths greater than 300 mm unless there is additional support in the front of the cylinder.
MF3 - Front & Rear Flange	Do not allow the body of the cylinder to twist while aligning the front and rear mounting flanges to their mating surfaces.
MP2 - Rear Clevis	Use a flexible rod end or load attachment to compensate for system misalignment. Example: FC2, FE2, or FS2 rod ends
MS1 - Side End Angle Brackets	Each mounting screw must be able to withstand a peak shear-force of 4488 N (EC2); 8896 N (EC3); 15569 N (EC4); 26689 N (EC5).
MS2 - Side Lugs	Each mounting screw must be able to withstand a peak shear-force of 4488 N (EC2); 8896 N (EC3); 15569 N (EC4); 26689 N (EC5).
MS6 - Side Tapped Holes	Each mounting screw must be able to withstand a peak shear-force of 4488 N (EC2); 8896 N (EC3); 15569 N (EC4); 26689 N (EC5).
MT4 - Trunnion Mount	Use a flexible rod end or load attachment to compensate for system misalignment.

Mounting Rod Ends

As with mounting styles, different rod ends also require certain application considerations. Find your rod end(s) in the table below and pay special attention to the corresponding "Application Requirements" column.

Rod End Style	Application Requirements
FC2 - Clevis w/MT1 Thread	Clevis must be secured by its locknut when in desired position. The mounting pin must be secured with a cotter pin after it is inserted into the double clevis holes.
FS2 - Spherical Joint	Not recommended if stiff or rigid load attachment is required.
FT1 - Female Thread	Any attachment to an FT1 rod end must be secured in place by a locknut.
MT1 - Male Thread	Any attachment to an MT1 rod end must be secured in place by a locknut.

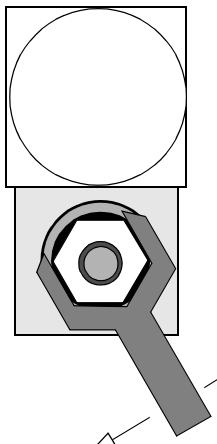
Attaching the Load to the Rod End

Warning!

Do Not Exceed the Maximum Torque Limits on the Thrust Tube when attaching the load to the rod end. Failure to heed this warning could cause irreparable damage to the internal guide flange. Maximum torque limits are shown on the drawing below.

Hexagonal flats are provided at the end of the thrust tube to prevent rotation while the rod end attachment is being secured.

EC Series	Maximum Torque			
	"A"		"B"	
	N-m	ft-lbs	N-m	ft-lbs
EC2	68	50	27	20
EC3	88	65	41	30
EC4	163	120	68	50
EC5	163	120	68	50



Do Not Exceed "B" ft-lbs torque in the Counter Clockwise (CCW) direction

Use wrench on flats to prevent rotation of thrust tube during load attachment

Do Not Exceed "A" ft-lbs torque in the Clockwise (CW) direction

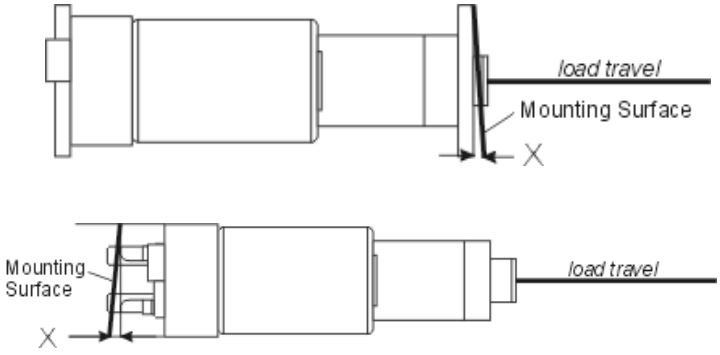
Aligning the Electric Cylinder to the Load

Load-travel alignment is critical for the prevention of binding and premature wear of internal components. The following alignment procedures and specifications have been developed for users who demand the highest level of precision and longest life from their IDC electric cylinders.

Alignment Using MF1, MF2, MF3, MP2, MP3, or MT4 Cylinder Mounting Styles

1. Ensure that the mounting surface is within "X" millimeters from perpendicular to the travel of the guided load. See illustrations below.
2. Mount the cylinder loosely to the mounting surface, i.e. all mounting screws are installed but they are loose enough to allow the cylinder to move in the mounting.
3. Attach the guided load system to the cylinder rod end.
4. Reduce as much weight as possible from the guided load system.
5. Run the cylinder for 5 to 10 cycles, allowing the cylinder to align itself to the guided load system.
6. Tighten the cylinder mounting screws according to the torque specifications for your specific hardware.

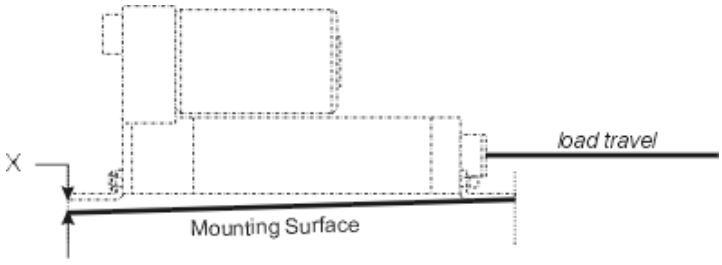
EC Series	"X"	
	mm	inches
EC2	0.03	.001
EC3	0.04	.0015
EC4	0.05	.002
EC5	0.05	.002



Alignment Using MS1, MS2, or MS6 Cylinder Mounting Styles

1. Ensure that the mounting surface is within "X" millimeters from parallel to the travel of the guided load. See table and illustration below.
2. Mount the cylinder loosely to the mounting surface, i.e. all mounting screws are installed but they are loose enough to allow the cylinder to move from side to side.
3. Attach the guided load system to the cylinder rod end.
4. Reduce as much weight as possible from the guided load system.
5. Run the cylinder for 5 to 10 cycles, allowing the cylinder to align itself to the guided load system.
6. Tighten the cylinder mounting screws according to the torque specifications for your specific hardware.

Cyl. Length mm [in]	"X" mm [in]
50 [2]	0.04 [.002]
100 [4]	0.06 [.002]
150 [6]	0.08 [.003]
200 [8]	0.10 [.004]
250 [10]	0.12 [.005]
300 [12]	0.14 [.006]
450 [18]	0.20 [.008]
600 [24]	0.26 [.010]
750 [30]	0.32 [.013]
1000 [40]	0.42 [.017]
1250 [50]	0.52 [.020]
1500 [60]	0.62 [.024]



Installing Position Sensors for Overtravel Protection

Although an "elastomeric spring" inside the cylinder is designed to prevent cylinder jams, position sensors (aka limit switches) are required to prevent such potentially damaging jam conditions. If the motor is accidentally commanded to move toward a hard-stop, position sensors can signal a stop before a collision occurs. To work properly, position sensors must be positioned inward from the hard-stop, and wired correctly to the motor controller.

Note: Using the physical limits of the cylinder (hard stops) will reduce cylinder life and can cause premature component failure.

Position Sensor Specifications for Sensors Used on EC Electric Cylinders							
Sensor Series		**PSR-1**	**PSR-2**	**PSN-1**	**PSN-2**	***PSP-1**	***PSP-2**
Sensor Type		Mechanical Reed		Hall-Effect			
Output Type		Contact Closure		Sinking, Open Collector (NPN)		Sourcing (PNP)	
Connection		Norm. Open	Norm. Closed	Norm. Open	Norm. Closed	Norm. Open	Norm. Closed
LED Color		Green	Red	Green	Red	Yellow	Red
Leads (wiring)		2 + shield, 26 AWG, 3 meters		3 + shield, 26 AWG, 3 meters			
Supply	**Voltage**	8-120V (AC or DC)		5, 12, or 24 VDC			
	Current			5 mA @ 12 VDC; 10 mA @ 24 VDC			
	Power			0.24 W			
Leakage Current (max)				0.01 mA			
Output	**DC Maximum**	120VDC		8-30VDC			
	AC Maximum	120VAC					
	Current Max.	40mA		100mA			
	Power Max.	5W		3W			
Operating Temp.		-4° to 158°F [-20° to 70°C]					
Storage Temp.		-4° to 176°F [-20° to 80°C]					
Environmental Rating		IEC Standard IP67					
***Not compatible with IDC motion controllers**							

Mounting Location - Deceleration Distance

The position sensor's location along the cylinder is associated with the beginning of a deceleration, not the final stopping point. Therefore, position sensors must be mounted inward of the cylinder hard-stops to provide a slowdown area to prevent jamming. The faster the approach speed, the longer it takes to stop the cylinder, so deceleration distance varies with cylinder speed, load, and cylinder/control type. A small amount of adjustment may be necessary during initial setup.

Important Installation Notes

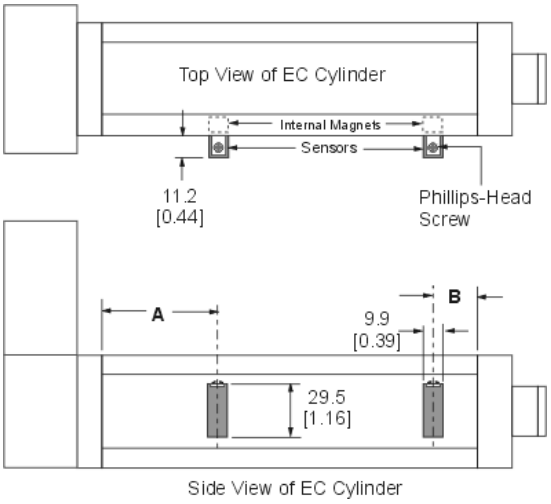
1. Position sensors may be mounted along either side of an EC cylinder. Labels (example shown) indicate the sides of the cylinder where position sensors can be installed.
2. Distance between sensors should be 1.50 inches or more. If sensors are located closer than 1.50 inches apart, they could trigger at the same time.
3. Using position sensors for end-of-travel protection reduces effective travel distance. Consult the factory.
4. **IDC's D2200, D2300 and D2400 series controls use only PSR-1 and PSN-1 position sensors.**

CAUTION

When installing a position sensor, tighten the clamp screw to a maximum 7.0 oz-in of torque. Failure to heed this caution could cause irreparable damage to the sensor. Tighten the clamp screw gently and only to the point where the sensor assembly feels secure and does not slide along the cylinder wall.

Position Sensor Dimensions and Mounting Locations

The illustrations below show sensor mounting locations when cylinder magnet and sensor are physically aligned. These locations are recommended as a starting point when setting up a cylinder for the first time. Depending on the speed and payload of the application, sensors may be moved inward to prevent a hard-stop crash when the load travels at full speed past a limit switch.



See "Caution" on previous page before attempting to tighten the installation screws on a position sensor

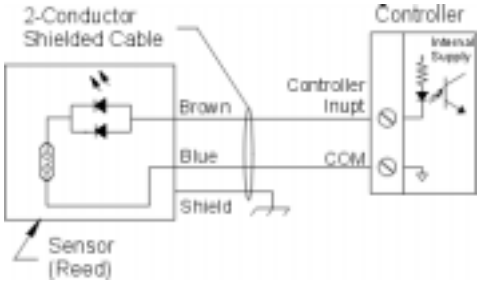
Dimensions "A" and "B" are approximate end-of-stroke locations for the position sensors.

EC Series	Dim "A" mm [in]	Dim "B" mm [in]
EC2	73.3 [2.90]	48.3 [1.90]
EC3	77.0 [3.03]	56.6 [2.23]
EC4	137.0 [5.39]	63.0 [2.48]
EC5	137.0 [5.39]	63.0 [2.48]

Sensor-to-Controller Connections

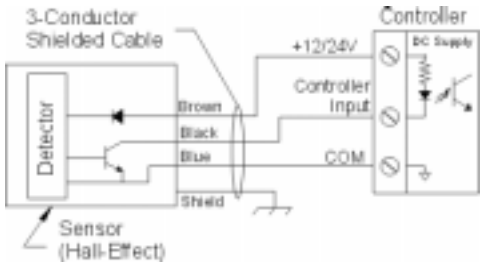
The sensor connection diagrams below show wiring color codes and controller inputs for connecting each type of position sensor.

PSR Reed Sensor

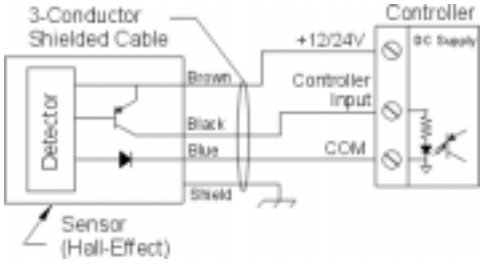


Note: The black wire in *Quick Disconnect* cables is not used with any version of the PSR (Reed) sensor. In the above drawing, only the blue wire, brown wire, and shield are connected.

PSN Hall-Effect Sensor



***PSP Hall-Effect Sensor**



*****PSP sensor is not compatible with IDC controls.

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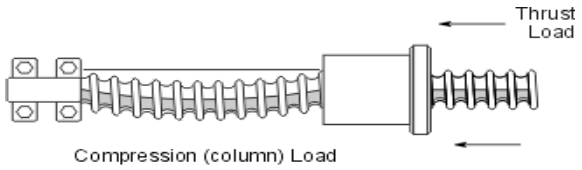
5. Application Considerations

Certain conditions can limit cylinder performance and should be addressed prior to installation and operation. Adherence to the following application guidelines will ensure a successful application.

Column Load Limit

Exceeding the Column Load Limit will cause the leadscrew to buckle and become permanently damaged. The Load Limit Table below contains Column Load Limits per stroke length and screw type.



Load Limit Table for Standard Stroke Lengths				
EC Cylinder Stroke Length	***Column Load Limit (N) per EC Series with Applicable IDC Screw Type in Parentheses**			
	EC2	**EC3**	**EC4**	**EC5**
50 - 600 mm				
750 mm	**2500 (04A)**	**4900 (16B)**		
1000 mm		**2780 (16B) 4650 (04A) 5340 (10B) 6530 (05B)**		
1250 mm			**10300 (10B)**	
1500 mm			**7400 (10B) 8600 (25B)**	
*Shaded areas indicate NO Column Loading Restriction (for example: Column Load Limits do not apply to any length of EC5 cylinder or to 32B Screws).				

Column Load Limits for Custom Stroke Lengths

If you require a Column Load Limit for a **custom** stroke length between 750 and 1500 mm, consider the following options:

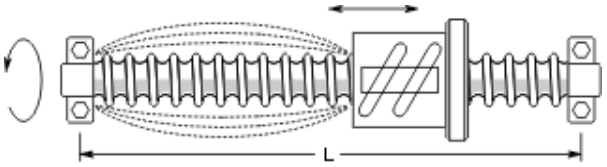
1. Contact IDC Applications Engineering for a custom Column Load Limit.

2. Use the Column Load Limit for the next shorter stroke length. Example: for an EC3 of 1100 mm with an 04A screw, use *4650 N*.

Critical Speed Limit

All leadscrew systems have a critical speed at which harmonic vibrations begin to occur. **Sustained operation beyond this critical speed limit (see tables below) may cause the leadscrew to vibrate or whip violently, eventually bending or warping the screw (see illustration).**

Observing the maximum speed limits in the tables below will help prevent damage to your EC cylinder.



Screw Type	Maximum Speed per Cylinder Stroke Length (Speed = mm/sec)															
	50 - 200 mm				300 mm				450 mm				600 mm			
	EC2	EC3	EC4	EC5	EC2	EC3	EC4	EC5	EC2	EC3	EC4	EC5	EC2	EC3	EC4	EC5
04A	233	200			219	200			119	144			72	89		
05B	414	261			310	261			172	199			103	119		
10B		533	388			533	388			398	388			239	263	350
16B	1280				993	866			550	530			331	318		
25B			1333				1333				1059				657	
32B				1333				1333				1333				1120

Note: Shading indicates non-applicability.

Table continued

Important Note:
IDC programmable controls have a maximum-velocity parameter that can be configured not to exceed the "critical speed."

Screw Type	Maximum Speed per Cylinder Stroke (Speed = mm/sec)										
	750 mm				1000 mm			1250 mm		1500 mm	
	EC2	EC3	EC4	EC5	EC3	EC4	EC5	EC4	EC5	EC4	EC5
04A	48	61			33						
05B	71	84			48						
10B		212	185	254	96	119	156	63	99	53	72
16B	230	216			127						
25B			462			298		171		131	
32B				814			499		316		229

Duty-Cycle Limits

Duty-cycle is the percentage of **ON Time** divided by **Total Cycle Time** for the worst-case 10-minute period. During operation, duty-cycle represents the maximum acceptable power dissipation of the motor and the frictional heat losses of the internal cylinder components, primarily the leadscrew/drivenut assembly. In general, ballscrew cylinders are rated for 100% duty cycle and ACME screws are rated for a maximum of 60%. Your motor may also have duty-cycle limitations. Consult your IDC Catalog or *www.idcmotion.com* for more information on duty-cycles. Exceeding the recommended duty-cycle will damage the motor or internal cylinder components.

Environmental Specifications

The following environmental specifications must be observed for optimal cylinder performance:

Temperature Rating - The operational temperature range for all EC cylinders is -30° to 70° C [-22° to 158° F]. When operating below 2° C [35° F], a vent tube must be installed (see below).

Preventing Exposure to Contaminants

Liquids: Standard EC cylinders are water-resistant for environments with a slight mist on the cylinder body but not on the thrust tube. If liquid or moisture contaminates internal components, damage may occur. Standard EC cylinders are IP54-rated.

The IP65-rated Protective Boot option (-PB) is available to protect the thrust tube/wiper interface. The standard EC cylinder provides a seal between the motor and cylinder body, but does not protect the motor itself.

For applications where exposure is unavoidable with a corrosive liquid or a pressurized liquid, an external protective enclosure is recommended. Consult the factory for assistance.

Solid Particles: Rod-type cylinders are generally well protected against particle contaminants. For environments with exposure to fine or abrasive particles, the standard EC cylinder provides added resistance to entry by sealing mating surfaces with gaskets during assembly. The Protective Boot (-PB) option is recommended when the thrust tube/sleeve bearing interface is exposed to abrasive particles or water spray.

Installing a Vent Tube Fitting (included with all EC cylinders)

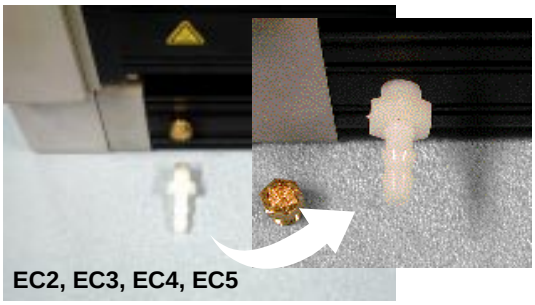
A Vent Tube is required when:

- ***Any*** EC cylinder is equipped ***with*** the -PB option.
- Operating ***any*** EC cylinder ***below 2° C*** [35°F].
- Operating any ***non PB-equipped*** EC cylinder in an environment of solid contaminants (i.e. dust, paper, or wood particles).

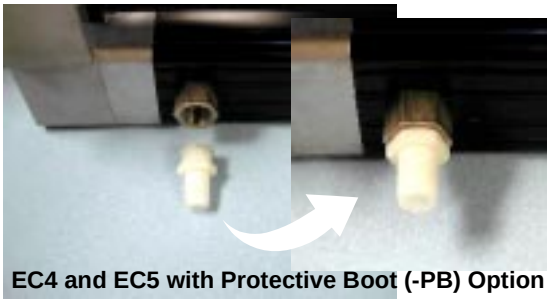
Installation

1. Remove breather plug from all cylinders except EC4 and EC5 with -PB option.
2. Install white plastic vent tube fitting.
3. Connect tubing (customer-supplied) to the vent tube fitting. See table for size of tubing required.
4. If the cylinder has the -PB option and/or is being operated below 2° C [35° F], connect the other end of the tubing to a **non-contaminated air source of 0 psi**.

   If the cylinder does not have the -PB option, *and* is being operated in an *environment of solid contaminants*, connect the other end of the tubing to a **non-contaminated positive pressure source of 2 to 3 psi**.



EC2, EC3, EC4, EC5



EC4 and EC5 with Protective Boot (-PB) Option

Vent Tubing Sizes

EC Series	Size Tubing Required
EC2 and EC3	1/4-inch inside diameter
EC4 and EC5	3/8-inch inside diameter
EC4 and EC5 with PB option	3/4-inch inside diameter

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6. Optional Equipment - Specifications, Dimensions, and Wiring

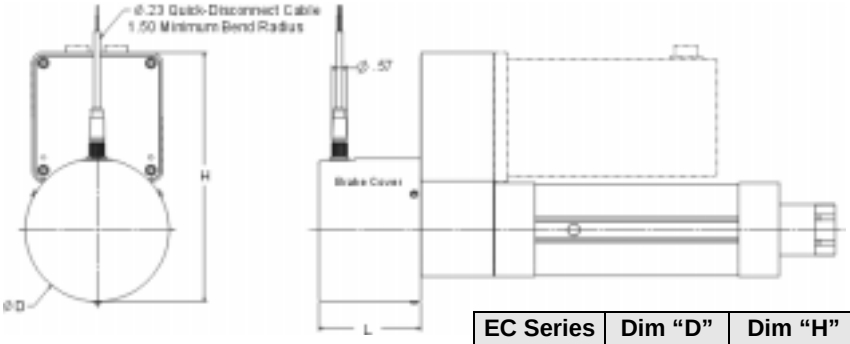
Brake on Leadscrew Option (-BS24, -BS115, -BS230)

This brake option provides a spring-set, electrically-released friction brake mounted to an extension of the leadscrew. It prevents backdriving when the unit is at rest, or in case of power failure. The brake is engaged when power is not applied. Applying power releases the brake, allowing motion to occur. **Application Note:** This option is used only for *in-position* holding, it should not be used for stopping a moving load.

Specifications

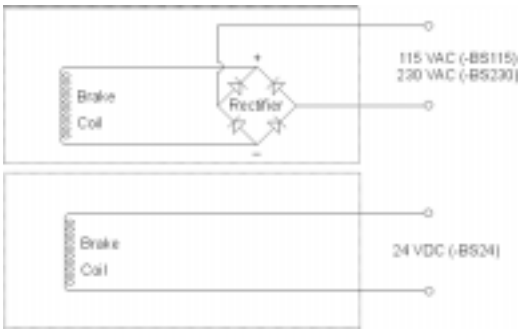
Specification Parameters	Leadscrew-Mounted Brake Configurations		
	-BS24	**-BS115**	**-BS230**
Voltage	24 VDC	115 VAC	230 VAC
Power *Watts*	EC2=12.5 EC3=7 EC4/5=15		
Holding Torque *N-m [in lbs]*	EC2=3.9 [35] EC3=6.7 [60] EC4/5=39.2 [350]		
Cable Length *m [ft]*	3.7 [12]		
Holding Force with -BS Brake Option	**EC Configuration**	**Screw Type**	**Holding Force**
	EC2	16B Ball (16 mm/rev) 05B Ball (5 mm/rev) 04A ACME (4 mm/rev)	1550 N [350 lbs] 3600 N [810 lbs] 3600 N [810 lbs]
	EC3	16B Ball (16 mm/rev) 10B Ball (10 mm/rev) 05B Ball (5 mm/rev) 04A ACME (4 mm/rev)	2660 N [600 lbs] 4260 N [960 lbs] 7200 N [1620 lbs] 7200 N [1620 lbs]
	EC4	25B Ball (25 mm/rev) 10B Ball (10 mm/rev)	9940 N [2230 lbs] 12000 N [2700 lbs]
	EC5	32B Ball (32 mm/rev) 10B Ball (10 mm/rev)	7770 N [1750 lbs] 24800 N [5590 lbs]

Dimensions



EC Series	Dim "D"	Dim "H"	Dim "L"
EC2	78.2 [3.08]	155.1 [6.10]	69.3 [2.73]
EC3	97.3 [3.83]	183.3 [7.22]	84.3 [3.32]
EC4/EC5	141.7 [5.58]	245.0 [9.64]	99.9 [3.94]

Electrical Connections



Brake on Motor Option (-BM24, -BM115, -BM230)

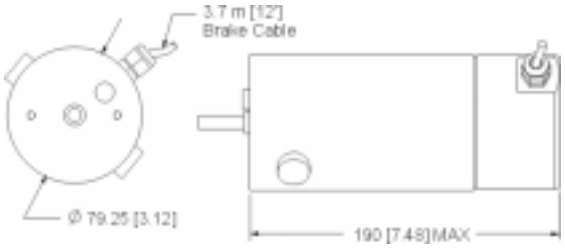
The motor shaft-mounted brake can be an advantage because brake torque is multiplied by the belt or gear reduction and does not interfere with certain rear cylinder-mounting options. A broken drive belt will render the motor-mounted brake inoperable. **Note:** This is a static brake, intended only for *in-position* holding. It should not be used for routinely stopping a moving load.

Brake on Motor Specifications

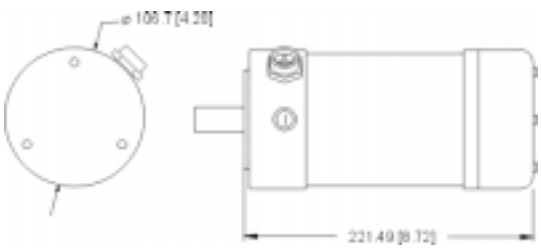
Parameter		Brake Specifications per Cylinder Configuration							
Cylinder		**EC2-H, EC3-H, EC4-H**			**EC2-B**	**EC3-B**		**EC4-B**	**EC5-B**
Motor Type		H, H4			B23	B23	B32	B32	B32	B41
Brake Type		-BM24	-BM115	-BM230	-BM24		-BM24			-BM24
Voltage		24 VDC	115 VAC	230 VAC	24 VDC		24 VDC			24 VDC
Current	*Amps*	0.25	0.05	0.03	0.21		0.52			0.88
Power	*Watts*	6			5		12.48			21.12
Holding Torque	*N-m [in-lbs]*	1.1 [10]			1.1 [10]		6.7 [60]			27 [240]
Cable Length	*m [ft]*	3.7 [12]			See Note Below					
Holding Force		Consult the Factory								
Note: Brake wiring included in B23 motor cable. Motor cable available in 12, 25, and 50-foot lengths.										

Dimensions

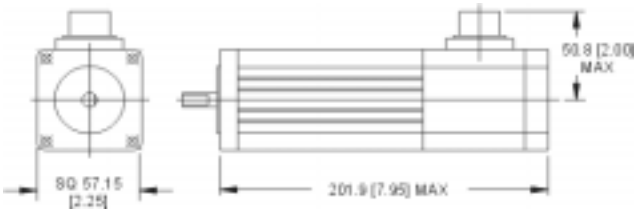
H Motor with Brake



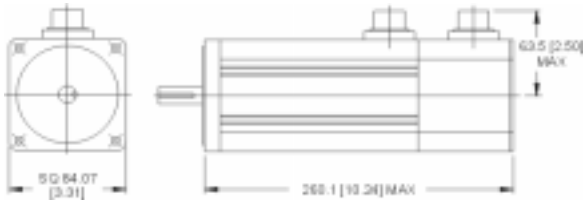
H4 Motor with Brake



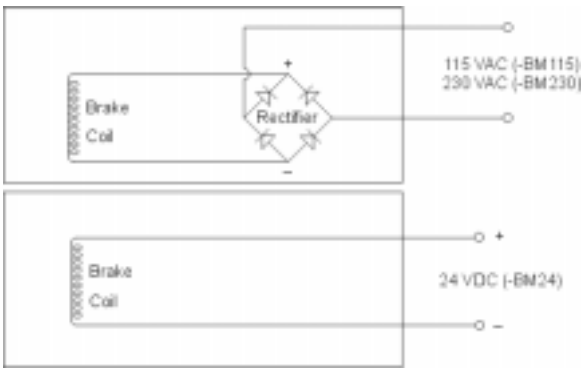
B23 Motor with Brake



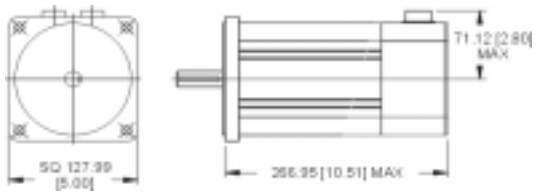
B32 Motor with Brake



Electrical Connections



B41 Motor with Brake



Note:
Observe polarity when using a -BM24 Brake with a B23, B32, or B41 Motor.

Encoder Option (-EMK/-EM)

The encoder option for EC-applicable motors provides an incremental rotary encoder, factory-mounted directly to the rear of the D, H, P22, P32, S32, and S42 IDC motors. The -EMK encoder is an industry-standard, 1000-line version, and the -EM is the 500-line version. The digital pulse output is used to provide position feedback to external devices such as motor controllers, counters, or PLC's. A 2000-line encoder is standard equipment on the B23, B32, and B41 motors.

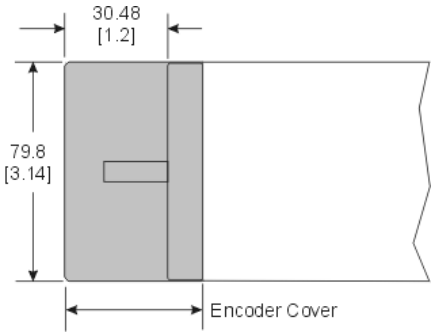
Specifications per EC-Applicable IDC Motor

Parameter	D, H, P22, S32, S42, Motors	P32 Motor	*B23, B32, B41 Motors
Pulses per Revolution	**-EMK** 1K line (4K post-quad) **-EM** 500 line (2K post-quad)	**-EMK** 1K line (4K post-quad) **-EM** 500 line (2K post-quad)	2000 line (8000 post-quad)
Output Pulse Format	Incremental, Dual Square Wave Quadrature, with Index Pulse		
Cable Length/Type *m [ft]*	3.7 [12]/Leads	3.7 [12]/Leads	3.7 [12]/MS Connector
Voltage	5 VDC ±5%		
Current	120 mA	135 mA	200 mA
Max. Speed	6000 rpm	12000 rpm	6000 rpm
Weight *kg [oz]*	0.17 [6.0]	.057 [2.0]	0.25 [8.8]
Inertia *kg-m^2 [oz-in-sec^2]*	5.1 x 10^{-9} [7.3 x 10^{-7}]	3.1 x 10^{-7} [4.4 x 10^{-5}]	1.0 x 10^{-6} [1.4 x 10^{-4}]
Operating Temp. *ºC [ºF]*	-10 to +70 [+14 to +158]	-10 to +100 [+14 to +212]	-20 to +100 [-4 to +212]
Storage Temp.e *ºC [ºF]*	-20 to +80 [-4 to +176]	-30 to +110 [-22 to +230]	-25 to +100 [-13 to +212]
*Not an option. Encoder is standard equipment on these motors.			

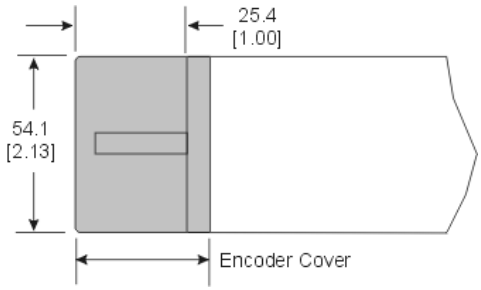
Dimensions

P32, S32, S42, B32, B23, and B41 Motors: Encoder is enclosed within the standard motor housing - no dimensional changes.

H Motor



D, P22 Motor



Encoder Connections

Motors: D, H, P22, P32, S32, S42	
Signal	**Color Code**
A+	Red
A-	Pink or Purple
B+	Green
B-	Blue
Z+	Yellow
Z-	Orange
+5 VDC	White
COM	Black

Motors: B23, B32, B41			
Signal	**Color Code (See Note)**		
A+	Blue	Blue	Blue
A-	Blue/Black	Yellow	Blue/White
B+	Green	Yellow/White	Yellow
B-	Green/Black	Red/ White	Yellow/White
Z+	Violet	Blue/White	Brown
Z-	Violet/Black	Black/White	Brown/White
+5 VDC	Red	Red	Red
COM	Black	Black	Black

Note: Due to different cable suppliers, your encoder cable will contain one of three possible color codes. Each column represents a color code for a different cable. Find the color code that matches your cable and use that column only.

Linear Potentiometer Option (-L)

The Linear Potentiometer resides within the cylinder housing and is energized by an external DC power supply. The potentiometer wiper moves in conjunction with the cylinder thrust tube providing an analog voltage feedback signal which is proportional to the linear displacement.

Example: Using a 5 volt supply, 0VDC = 0% Stroke; 2.5VDC = 50% Stroke; and 5 VDC = 100% Stroke

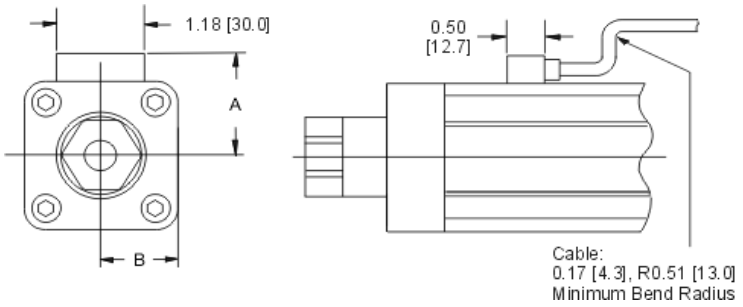
Application Notes

1. This option is not recommended for high vibration environments.
2. This option is required when the EC is used with IDC D2500, H3500, H4500, and B8500 series controls.

Specifications

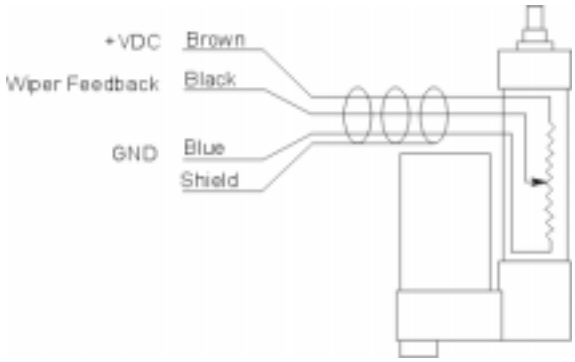
Stroke (mm)	Resistance (ohms)	Max. Non-Linearity
50	3000 ± 20%	±1%
100	6000 ± 20%	±1%
150	9000 ± 20%	±1%
200	9000 ± 30%	±1%
250	9000 ± 30%	±1%
300	7000 ± 30%	±1% (5% to 95% of function)
450	7000 ± 30%	±1% (5% to 95% of function)
600	7000 ± 30%	±1% (5% to 95% of function)

Dimensions
(Linear Pot top-mounted on EC cylinder)



EC Cylinder Model	DIM "A" mm [in]	DIM "B" mm [in]
EC2	37.3 [1.47]	28.5 [1.12]
EC3	43.7 [1.72]	34.8 [1.37]
EC4	54.5 [2.15]	46.1 [1.82]
EC5	54.5 [2.15]	46.1 [1.82]

Electrical Connections



7. Factory Service and Routine Field Maintenance

While we recommend factory service in most cases, we recognize that it may occasionally be necessary to perform minor repairs or maintenance in the field. Such cases include replacing worn or broken components (i.e. belts, rod ends, or mounting hardware) and lubrication of leadscrew or gears as required in extreme applications.

All routine maintenance procedures must be performed by qualified personnel, using only IDC-supplied or IDC-recommended parts and supplies. Improper routine maintenance which causes damage or premature wear will void the factory warranty.

The table below is provided as a quick reference to help users decide whether to return a unit to the factory or allow qualified personnel to perform routine maintenance in the field.

Factory Service Required	Routine Maintenance Procedures	Page #
Belt/Pulley Ratio Conversion (1:1, 1.5:1, 2:1)	Pulley and Pinion Installation	22-23
Helical Gear System Ratio Conversion (5:1 and 10:1)	Lubricating the Leadscrew (excluding -BS and -L options)	24
Leadscrew Modification	Checking and Adjusting Drive Belt Tension*	25
Motor Orientation Modification	Lubricating Gears	26
Mounting or Rod End Modification	*Aligning Motor Pinion	27
Cylinder Option Modification (-BS and -L)		
Any Repair to Motor Pulley, Drive Belt, Gear, Motor Pinion, Intermediate Gear, or Inline Coupling/Sleeve		

*This procedure was developed for users of IDC motors, but it may also be applicable to certain customer-supplied motors.

Performing Inspections and Routine Maintenance

- **Why Perform Inspections and Routine Maintenance in the Field?**
  Periodic inspection and routine maintenance can extend the life of your cylinder, especially under *extreme operating conditions*.

- **What are Extreme Operating Conditions?**
  Applications such as continuous high speed operation, high speed stops/starts, or exposure to harsh environments.

- **When Should Routine Maintenance be Performed?**
  In such extreme applications, it is recommended that the leadscrew and gears be re-lubricated, and an internal inspection be completed every *1,000,000 inches of cylinder travel. Inspection/re-lubrication typically consists of partial disassembly, followed by cleaning, visual evaluation, and lubrication.

  *EC2 and EC3 cylinders with ACME leadscrews operating in high load/high duty-cycle applications should be re-lubricated every 200,000 inches of travel (see page 24).

Routine Maintenance Procedures

Routine maintenance procedures are provided in the remainder of this section. Order parts and supplies from your local IDC Distributor.

Prevent Injury to Personnel

Do not attempt to perform any routine maintenance procedure while power is connected to the motor/ cylinder.

Hardware Torque

Before attempting any routine maintenance procedure, become familiar with the Torque Specification Table below. **Always refer to this table before applying torque to any of the listed parts**.

Torque Specification Table				
Description of Part	**Reference # (see Exploded Parts Diagrams)**	**Hardware Size**	**Maximum Torque (N-m)**	**Maximum Torque (in-lbs)**
Screw, Guide Cylinder	17, 33, 53	M5X.8 M6X1 M10X1.5	4.24 9.9 41	50.89 87.62 362.86
Screw, Set	22, 36	M4X.7 M6X1	0.94 4.3	8.32 38.06
Screw, Set, Coupling	4, 58	10-24 UNC 1/4 - 20 UNC	2.83 4.53	25.05 40.09
Screw, Motor Mounting	39	M4X.7 M5X.8 M6X1	2.9 5.75 9.9	25.67 50.89 87.62
Screw, Cover Plate	18	M4X.7 M5X.8 M6X1	2.9 5.75 9.9	25.67 50.89 87.62

Lubricants and Adhesives

When a specific lubricant or adhesive is required, it will be specified within the applicable procedure.

Installing a Pulley, Pinion, Reverse Pinion, or Coupling

Refer to the applicable illustration and dimensions table on the following page for your pulley, pinion, reverse pinion, or coupling placement.

1. Clean the motor shaft and bore free of any grease.

2. Apply Loctite #680 (green) to the motor shaft and the bore of the pulley, pinion, or coupling.

3. Slide pulley, pinion, reverse pinion, or coupling onto the motor shaft with a rotating motion to evenly distribute the Loctite.

4. See Application Note # 2. Position the pulley, pinion, reverse pinion, or coupling according to the applicable drawing and table on the following page.

5. Ensure that one setscrew is positioned on a flat, in a dimple, over a key or keyway.

6. Apply Loctite #262 (red) to the setscrew(s).

7. Tighten setscrew(s).

8. Refer to the motor-mounting procedure on page 28.

Application Notes

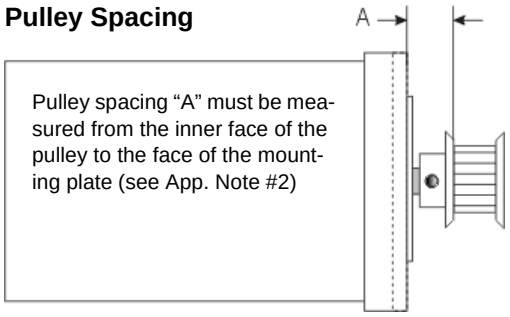
1. **WARNING!** The combination of pulley placement and operating torque may exceed motor shaft-load capacity. It is the user's responsibility to verify adequate shaft-load capacity.

2. If a supplemental mounting plate or adapter is used, it must be installed *before* measuring pulley, pinion, reverse pinion, or coupling spacing.

3. All spacing dimensions for pulleys, pinions, reverse pinions, or couplings have a tolerance of ±0.13 mm (±.005 inches).

Spacing Requirements

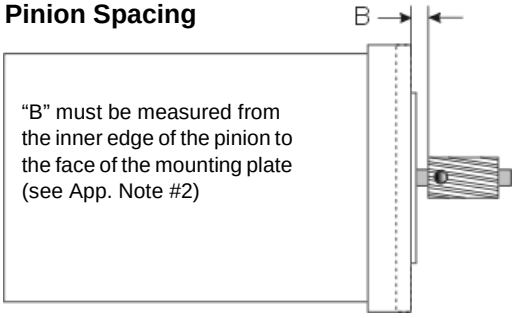
Pulley Spacing



Pulley spacing "A" must be measured from the inner face of the pulley to the face of the mounting plate (see App. Note #2)

EC Series	Motors	Dimension "A" mm [in]
EC2	D, H, P22, S32, B23, NEMA 23/34	11.63 [0.458]
EC3	D, H, P32, S32, B23/32, NEMA 23/34	13.08 [0.515]
EC4	H4, P32, S32, B32, NEMA 34/42	18.06 [0.711]
EC5	H4, P32, S32/42, B32/41, NEMA 34/42	18.06 [0.711]

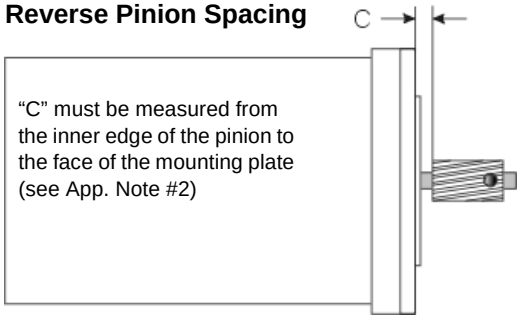
Pinion Spacing



"B" must be measured from the inner edge of the pinion to the face of the mounting plate (see App. Note #2)

EC Series	Motors	Dimension "B" mm [in]
EC2	S32, P22, NEMA 23/34	9.40 [0.370]
	B23	3.68 [0.145]
EC3	D, P32, S32, B23/32, NEMA 23/34	3.30 [0.130]
EC4	H4, P32, S32/42, B32, NEMA 34/42	2.82 [0.111]
EC5	P32, S32/42, B32, NEMA 34/42	2.82 [0.111]

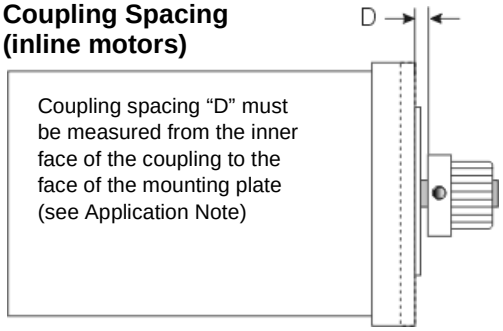
Reverse Pinion Spacing



"C" must be measured from the inner edge of the pinion to the face of the mounting plate (see App. Note #2)

EC Series	Motors	Dimension "C" mm [in]
EC2	H & D only	6.73 [0.265]
EC3	H only	10.67 [0.420]
EC4	N/A	N/A
EC5	H4 & B41 only	15.72 [0.619]

Coupling Spacing (inline motors)



Coupling spacing "D" must be measured from the inner face of the coupling to the face of the mounting plate (see Application Note)

EC Series	Motors	Dimension "D" mm [in]
EC2	D, H, P22, S32, B23, NEMA 23/34	8.00 [0.315]
EC3	D, H, P32, S32, B23/32, NEMA 23/34	7.62 [0.300]
EC4	H4, P32, S32, B32, NEMA 34/42	8.79 [0.346]
EC5	H4, P32, S32/42, B32/41, NEMA 34/42	8.79 [0.346]

Lubricating the Leadscrew

In high-load and/or high duty-cycle applications, EC2 and EC3 cylinders with ACME screws should be re-lubricated every 200,000 inches of travel. All other EC cylinders should be re-lubricated every 1,000,000 inches of travel. EC2 and EC3 cylinders with ACME screws, and *all* EC4 and EC5 cylinders include a lube port and lube adapter (nozzle) for a standard lubrication dispenser (grease gun).

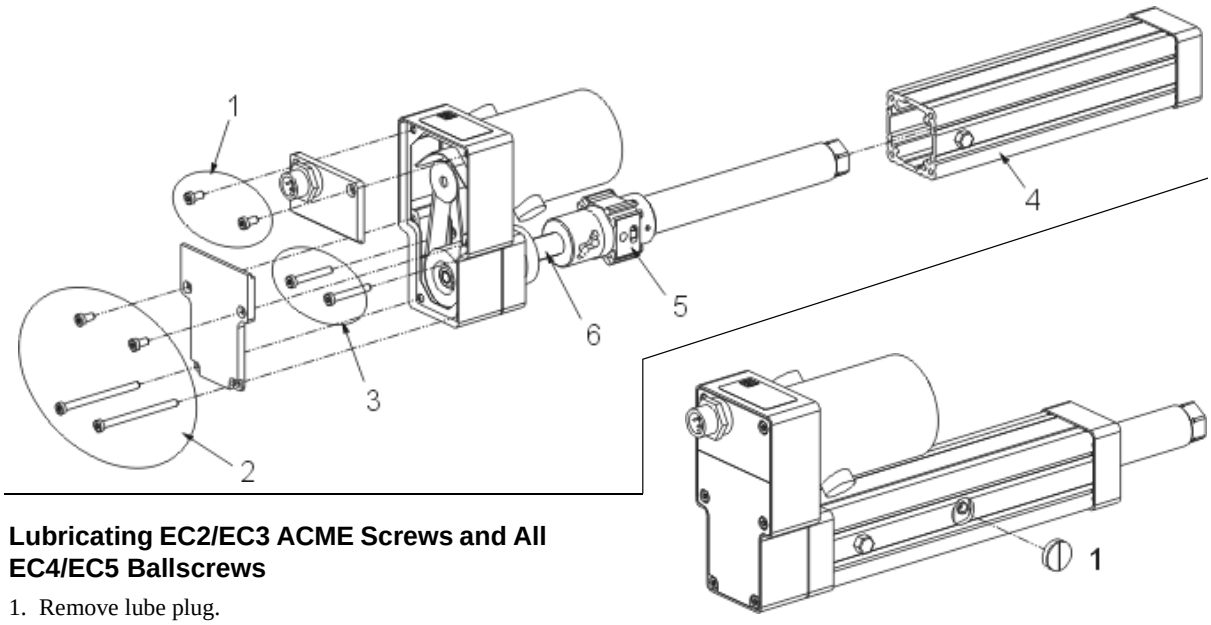
Note: Do not attempt to lubricate the leadscrew of a cylinder with the -L (Linear Potentiometer) Option. This procedure must be done at the factory.

Recommended Lubricants	
Type of Leadscrew	**Type of Lubricant**
Ballscrews with 05B, 10B, 16B, 25B, and 32B Screws	NLGI Grade 2, Synthetic Base Lithium Grease
ACME Screws with Bronze ACME Nut (04A Screws)	NLGI Grade 2, Synthetic Base Grease with PTFE Additive

Lubricating EC2/EC3 Ballscrews

1. Remove upper rear cover plate from the gear housing (EC2 only) by removing two (2) SHCS.
2. Remove main rear cover plate by removing four (4) SHCS.
3. Loosen two (2) SHCS (inside gear housing) that secure the upper part of the guide housing. **These screws must be loosened in consecutive increments**; i.e. 2 turns on one screw, then 2 turns on the other, repeating until each is loose. **Note:** these are captive screws and cannot be removed as shown in the illustration below.
4. Remove guide housing by sliding it away from the thrust tube.
5. Move the drive nut (attached to thrust tube) to the far end of the leadscrew.
6. Remove as much of the old grease from the leadscrew as possible.
7. With most of the leadscrew exposed, apply no more than 0.8 mm (.03") of the recommended lubricant over the length of the screw. Run the drivenut over the screw length to spread the grease evenly. Wipe off any excess grease expelled from the leadscrew by the drivenut.
8. Reassemble Unit.

   Note: After lubricating the leadscrew, check belt tension on belt-driven cylinders (next page).



Lubricating EC2/EC3 ACME Screws and All EC4/EC5 Ballscrews

1. Remove lube plug.
2. Move cylinder to center stroke.
3. Install the IDC-supplied lube nozzle on your lube dispenser (aka grease-gun).
4. Insert lube nozzle through lube opening and onto the grease fitting.
5. **Caution- Do Not Overfill the Leadscrew with Grease!** Pump only 2.3 to 2.8 grams (.08 to 1.0 oz) of grease per 304.8 mm (12 inches) of cylinder travel into the leadscrew.

Checking/Adjusting Drive Belt Tension

1. Ensure power to the motor is OFF and the load is removed from the thrust tube.

2. Remove rear cover plate(s) as necessary for your particular EC cylinder.

3. Using finger pressure, push the drive belt inward. The belt should not deflect more than 3.17 mm (.125 inch) from a stationary centerline. If the drive belt deflects more than 3.17 mm (.125 inch), proceed to the following section that applies to your motor.

Adjusting Belt Tension on D and H Motors

1. Loosen two (2) motor-adjustment screws inside drive housing (shown below left) just enough to allow the motor to move. Both screws are in slots which allow up/down movement of the motor to change belt tension.

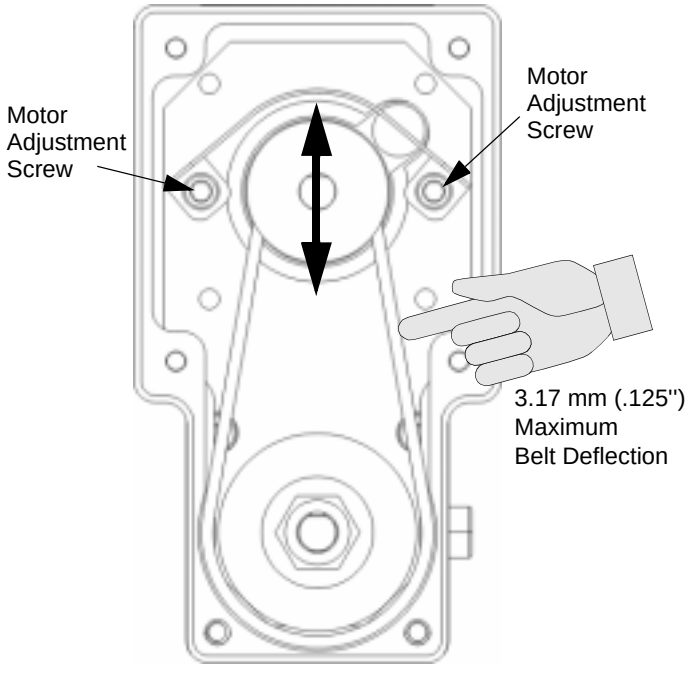
2. Move the motor up or down to adjust belt tension. While maintaining proper tension by hand, tighten both screws. Check belt tension again and reassemble unit.

Adjusting Belt Tension on P22, P32, S32, S42, B23, B32, and B41 Motors

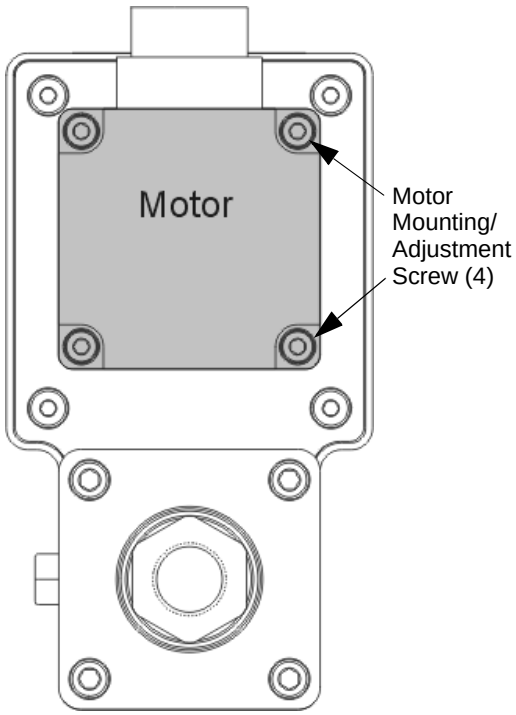
1. Loosen four (4) external motor mounting/adjustment screws (shown below right) just enough to allow the motor to move. All screws are in clearance holes which allow just enough up/down movement to adjust the belt tension.

2. Move the motor up or down to adjust belt tension. While maintaining proper tension by hand, tighten all screws. Check belt tension again and reassemble unit.

D/H/H4 Motors



P22/P32/S32/S42/B23/B32/B41 Motors



Lubricating Gears

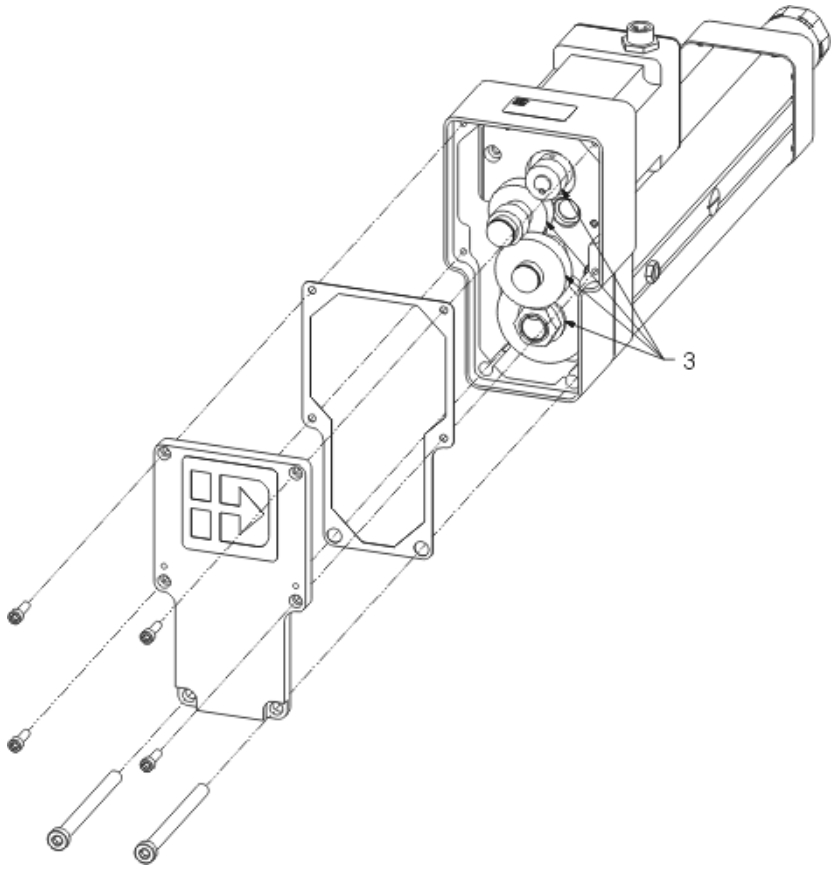
Recommended Lubricant: NLGI Grade 2, Synthetic Base Lithium Complex EP Grease

1. Remove rear cover plate(s) as necessary for your particular EC cylinder.

   Note: Cylinder with -BS (Brake on Leadscrew) option requires removal of the top cover plate only on EC2 cylinders.

2. Remove as much of the old grease from the gears as possible.

3. With the gears exposed, apply an ample amount of lubricant (6.35 mm [.25 in] or more) to all surface contact areas of gear train as shown in the illustration below. Reassemble unit.



Aligning Motor Pinion

1. Ensure power to the motor is OFF and the load is removed from the thrust tube.
2. Remove rear cover plate(s) as necessary for inspection. For cover plate removal, refer to steps 1 and 2 in "Lubricating Gears" earlier in this section. Reinstall cover plate(s).

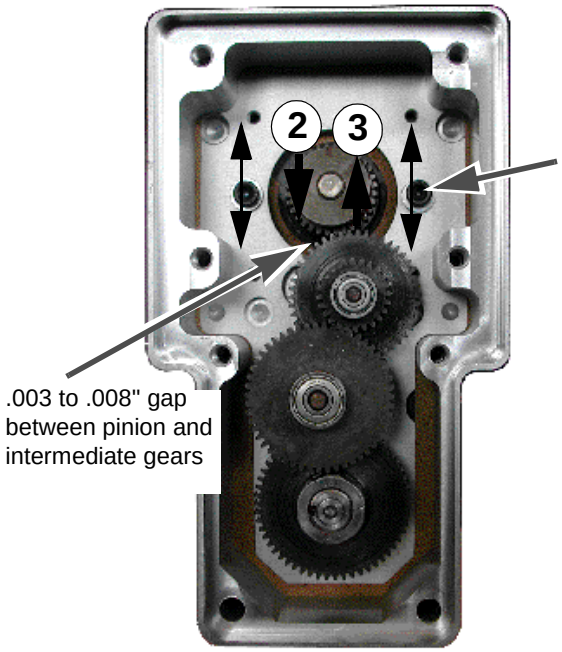
Aligning Motor Pinion on D, and H Motors (shown below)

1. Loosen two (2) mounting/alignment screws just enough to allow the motor to move. Both screws are in slots which allow up/down movement of the motor to align the motor pinion.
2. Move the motor pinion into the fully-meshed or seated position against the intermediate gear (i.e. pinion will not move any farther). See #2 in photo below.
3. From the fully-meshed position, back off or move the pinion gear away from the intermediate gear 0.076 to 0.203 mm (.003 to .008 in). See #3 in photo below.
4. While maintaining proper position by hand, tighten mounting/alignment screws. Install upper cover plate.

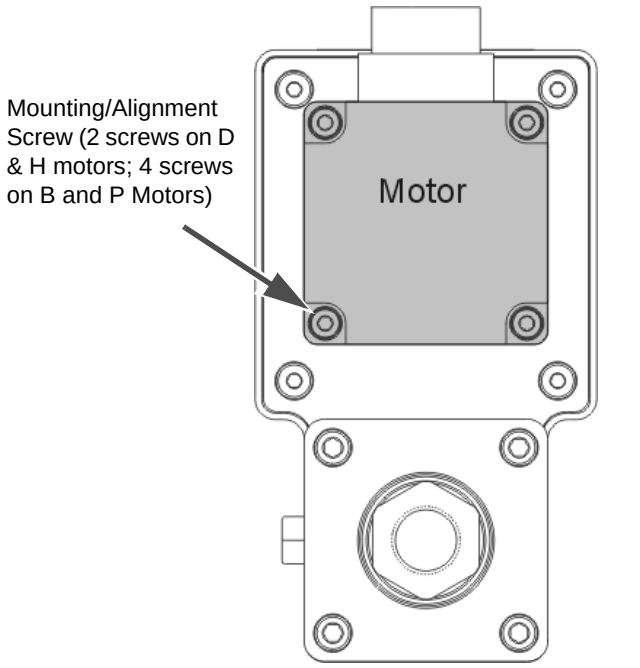
Aligning Motor Pinion on P22, P32, S32, S42, B23, B32, and B41 Motors

1. Loosen four (4) mounting/adjusting screws just enough to allow the motor to move. All screws are in clearance holes which allow just enough up/down movement to adjust the motor pinion.
2. Move the motor pinion into the fully-meshed or seated position against the intermediate gear (i.e. pinion will not move any farther). See step 2 on the D/H/H4 Motor photo.
3. From the fully-meshed position, back off or move the pinion gear away from the intermediate gear 0.076 to 0.203 mm (.003 to .008 in). See step 3 on the D/H/H4 Motor photo.
4. While maintaining proper position by hand, tighten mounting/alignment screws. Install upper cover plate.

D/H/H4 Motors



P22/P32/S32/S42/B23/B32/B41 Motor



8. Mounting a Customer-Supplied Motor

This procedure is provided for the user who will be mounting a non-IDC motor on an EC Cylinder. For this procedure it is assumed that the EC cylinder has been received without a motor.

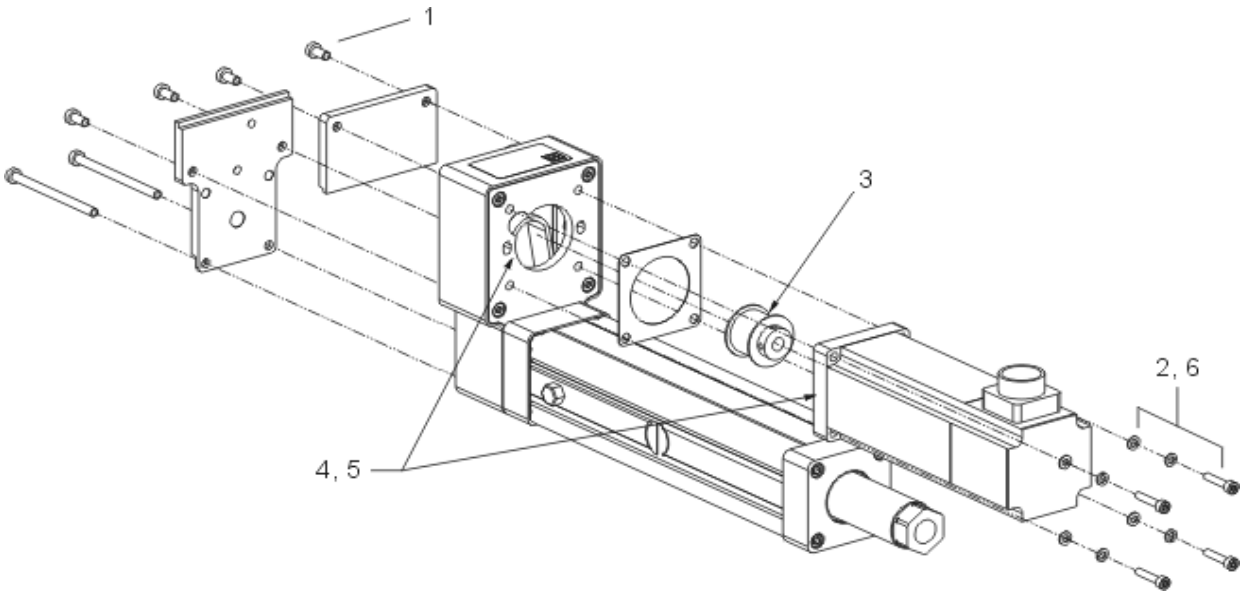
1. For parallel-mounted motors only, remove rear cover plate(s) from the gear housing (EC2 cylinders have two covers; all other EC cylinders have a one-piece cover plate).
2. Remove motor-mounting screws and washers from the cylinder motor mount.

   Note: If motor mounting screws and washers are not installed in the motor mount, they can be found packaged in a separate bag.
3. Install the motor pulley, gear pinion, or inline coupling per the installation procedure in section 7.
4. Using the following method appropriate to your application, insert the motor shaft and motor pilot into the gear housing through the hole in the mounting plate.

   Drive Belt: As you slide the motor and pulley through the mounting plate, lift the drive belt onto the teeth of the drive pulley. Refer to "Checking/Adjusting Drive Belt Tension" in section 7.

   Gear Drive: As you slide the motor and gear pinion through the mounting plate, gently engage and mesh the pinion with the intermediate gear. Refer to "Aligning Motor Pinion" in section 7.

   Inline Mounting: As you slide the motor and coupling through the mounting plate, rotate the motor coupling until it lines up the coupling sleeve inside the cylinder.
5. Continue to slide the motor shaft through the mounting plate until motor flange is flush with the motor mounting plate and the motor pilot is centered inside the mounting plate.
6. Secure the motor to the mounting plate using the motor mounting hardware previously removed.



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9. Troubleshooting

This section offers assistance when troubleshooting basic electric cylinder problems related to mechanical operation. When troubleshooting electric cylinder problems, the cause may be related to the drive or motor used with the cylinder. Refer to your drive/control user's manual for additional assistance on troubleshooting your system.

The following categories are covered in this section:

A. Audible Noise Emitting from Cylinder
B. Cylinder Motion
C. Positioning and Travel Length
D. Thrust Tube
E. Cylinder Parts and Options

Category/Symptom	Possible Cause	Possible Remedy
A. Audible Noise Emitting from Cylinder		
Knocking, squealing or grinding during operation	Misalignment of internal components	Send back to factory for evaluation.
	Excessive Side-loading	Check side-load rating. Reduce side-load.
	Internal lubrication dried	Remove old lubricant. Re-lubricate the leadscrew and/or gears.
	Entry of foreign matter into cylinder body	Send back to factory for evaluation.
B. Cylinder Motion		
Stalls/Binds/Sticks during a move (erratic motion)	Load too great for cylinder/motor	Check cylinder rating. Reduce load.
	Excessive thrust tube side-loading	Check side-load rating. Reduce side load.
	Motor pulley, gear pinion, or coupling slipping	Re-install pulley, gear, or coupling onto the motor.
	Erratic motor/controller operation	Ensure functionality of the controller. Replace motor.
	Drive nut or internal bearing seizing (locking up) typically due to excessive duty cycle/temperature or entry of foreign matter into cylinder	Send back to factory for evaluation.
Running rough, not running smoothly	Misalignment of internal components	Send back to factory for evaluation.
	Excessive side-loading	Check side-load ratings. Reduce side-load.
	Internal lubrication dried	Remove old lubricant. Re-lubricate the leadscrew and/or gear.
	Entry of foreign matter into cylinder body	Send back to factory for evaluation.
Extends when it should retract (and visa versa)	Motor polarity reversed	Reverse motor polarity at the control.

Category/Symptom	Possible Cause	Possible Remedy
Vibrates during motion	Motor Unstable (servo gains, stepper resonance)	Reduce motor gain for servo-motors. Increase step resolution for step motors.
	Cylinder being operated at critical speed	Check critical speed limit. Reduce speed to less than critical speed.
	Misalignment of internal components	Send back to factory for evaluation.
No motor movement when commanded to move	Motor not connected or is damaged	Reconnect the motor. Replace the motor.
	Load too great for cylinder/motor	Check the load limit. Reduce the load.
	Problem with drive/control	Check output of drive/controller.
Does not move (or is erratic) although motor is rotating	Gear pinion, pulley, or coupling not secured to motor shaft	Secure gear pinion, pulley, or coupling to the motor shaft.
	Belt is loose or damaged	Adjust belt tension. Replace belt
	Bad gear alignment	Adjust gear pinion placement.
	Stripped teeth on gear	Send back to factory for evaluation.
	Threads are stripped on the drive nut (ACME)	Send back to factory for evaluation
Not running at rated speed	Load is too great for desired speed	Ensure cylinder is being operated below the speed/thrust curve. Decrease the load.
	Limited by critical speed (oscillation) of screw	Check the critical speed limits. Reduce the speed.
	Incorrect screw pitch or drive ratio	Enter the correct screw-pitch or drive ratio the controller.

C. Positioning and Travel Length

Cylinder backdriving (without holding torque on motor)	Backdriving force generated by load is greater than the static holding capacity of the cylinder	Check the rated backdriving force for the cylinder. Reduce backdriving force.
	Excessive external vibration	Mounting requires modification to isolate or reduce vibration
Cylinder backdriving (with holding torque on the motor	Backdriving force generated by load is greater than the holding capacity of the screw/nut of the cylinder and the holding torque of the motor	Reduce backdriving force.
	Loss of motor holding torque (servo and steppers)	Recycle power to the motor and controller
Not enough travel	Position-Sensors reducing "actual" travel	Adjust sensors to increase cylinder travel without allowing cylinder to hit its internal hard-stop bumper.
	Excessive side-loading	Check side-load rating for the cylinder. Reduce side-load.
	Customer mounting is physically limiting travel	Re-design mounting

Category/Symptom	Possible Cause	Possible Remedy
Expected linear travel distance not corresponding to number of motor revs	Incorrect screw pitch or drive ratio	Check screw-pitch and drive ratio of the cylinder. Enter correct pitch and ratio in the controller
	Incorrect scaling factor (programmable controllers)	Enter correct scaling factor in the controller
Expected stop position not repeatable (in same direction)	Load varies from cycle to cycle.	Change load to be more consistent from cycle to cycle
	Erratic Motor/Control operation	Contact motor/control vendor for more information.

D. Thrust Tube

Wobbles during extension	Leadscrew or thrust tube is bent	Send back to factory for evaluation
	Excessive wear on leadscrew/nut	Send back to factory for evaluation
	Improper mounting of cylinder	Ensure cylinder travel is aligned with the travel of the load
Deflects too much during extension (Excessive lateral endplay)	Leadscrew/nut or internal bearings are worn	Send back to factory for evaluation
	Excessive side-loading	Check side-load rating. Reduce side load.
	Improper cylinder mounting	Ensure that cylinder travel is in line with the travel of the load
Bent thrust tube	Load too great for cylinder	Send back to factory for evaluation
	Excessive side-loading	
	Improper cylinder mounting	
Rotates (excessive radial play)	Internal guide flange is damaged	Send back to factory for evaluation
	Thrust tube not fully engaged in the internal guide flange	Rotate thrust tube clockwise until it stops turning. The maximum torque exerted on the thrust tube in ft-lbs is: EC2 [50], EC3 [65], EC4/5 [120].
Stuck in fully extended or retracted position	Drive nut physically jammed into end of travel	Remove rear cover(s) and rotate the leadscrew, gear, pulley, or coupling until the leadscrew turns freely. If jammed in extend, rotate CW. If jammed in retract, rotate CCW.
	Load too great for cylinder/motor	Check cylinder load rating. Reduce load
	Excessive side loading	Check side-load rating. Reduce side-load.
	Pulley, gear, or coupling slipping	Re-install pulley, gear, or coupling onto the motor.
	Erratic motor/drive operation	Contact motor/drive vendor for more information

Category/Symptom	Possible Cause	Possible Remedy
Excessive axial endplay (system backlash)	Leadscrew/nut is worn	Send back to factory for evaluation
	Gears worn	Send back to factory for evaluation
	Belt stretching	Re-tension belt

E. Cylinder Parts and Options

Drive belt breaking or gears stripping	Motor torque is too great	Reduce Accel and Decel
		Reduce load
	Motor accel/decel too great for given load	Reduce Accel or Decel
	Load is too great for cylinder	Check load rating of cylinder. Reduce load.
	Excessive shock loading (running into physical hardstop, rapid change in direction)	Reduce Accel/Decel of cylinder. Stop motion just before the hard stop.
Position Sensors not being activated by internal magnet	Misalignment of internal components	Send back to factory for evaluation
	Weak or missing internal magnet	Send back to factory for evaluation
	Switch/sensor is damaged or miswired	Check/correct switch wiring
		Send back to factory for evaluation
	Cylinder speed too fast	Reduce cylinder speed
Linear Potentiometer (LP) not reading properly	LPO wiper lifting off track (misalignment or LP bending due to excessive load	Ensure cylinder travel is in line with travel of the load
		Reduce load
	Damaged / contaminated LP (by liquid/particle)	Send back to factory for evaluation
Motor overheating	Duty cycle too high	Check duty cycle rating. Reduce duty cycle
	High ambient temperature	Use an external fan to cool the motor
	Incorrect current setting on drive	Check the control/drive user's manual for correct current settings. Reset the control/drive with correct current setting.
Brake not holding load	Brake not coupled to motor or leadscrew properly	Send back to factory for evaluation
	Load exceeds holding capacity of cylinder/brake	Check brake load rating. Reduce the load.
	Brake damaged	Send back to factory for evaluation
	Brake wired incorrectly	Check wiring and make corrections or repairs

Category/Symptom	Possible Cause	Possible Remedy
Encoder reading improperly	Encoder damaged	Send back to factory for evaluation
	Encoder wired incorrectly	Check wiring and make corrections or repairs
	Incorrect supply voltage to encoder	Check encoder voltage rating. Ensure correct voltage is supplied to the encoder.

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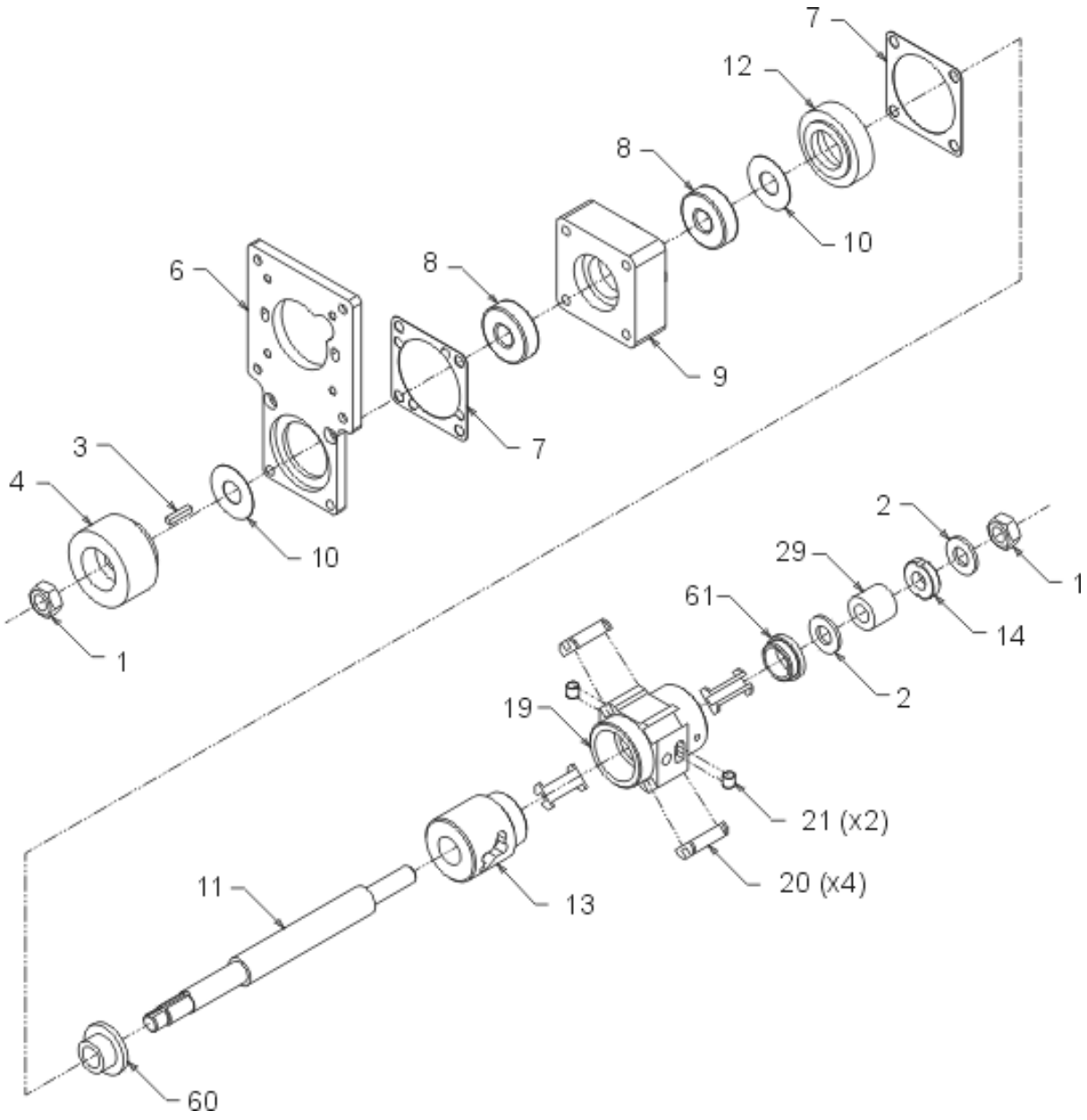
10. Parts List and Exploded Parts Diagrams

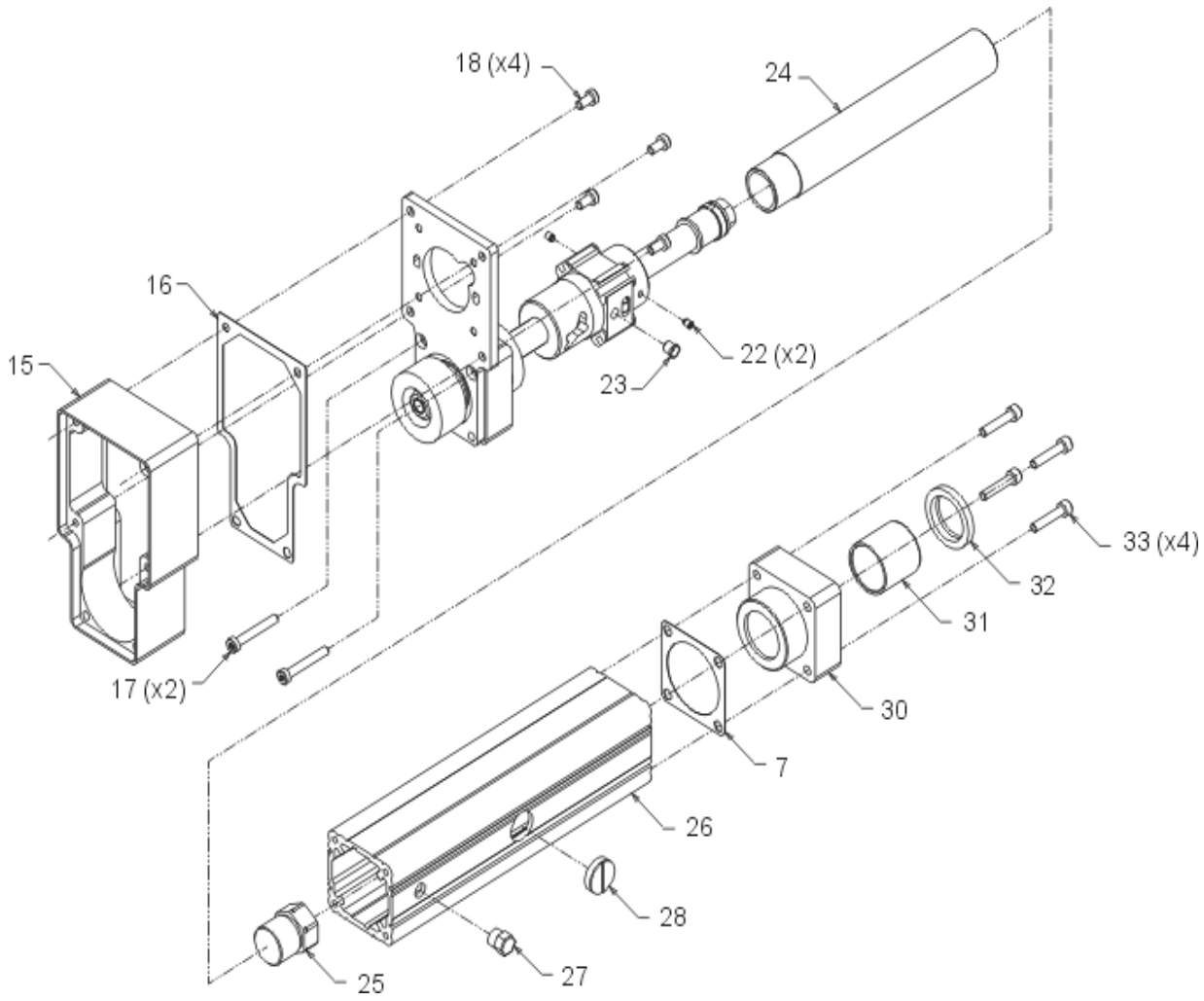
Parts can be ordered through your local IDC distributor. Kits include all essential parts and instructions. Item numbers below correspond with numbered items on the Exploded Parts Diagrams (see following pages).

Reference # on Exploded Parts Diagram	Description of Part	Reference # on Exploded Parts Diagram	Description of Part
1	Nut, Jam, Rear	33	Screw, Guide Cylinder, Front
2	Washer	34	Motor
3	Key, Pulley, Gear, or Coupling	35	Key, Motor Pulley, Gear, or Coupling
4	Pulley, Gear, or Coupling	36	Drive Pulley or Gear Pinion
5	Washer, Rear Bearing	37	Gasket, Motor
6	Plate, Motor Mounting	38	Washers, Lock, Motor Mounting
7	Gasket, Bearing Housing	39	Screw, Motor Mounting
8	Bearing, Leadscrew	40	Belt, Timing
9	Bearing Housing	41	Washers, Flat, Motor Mounting
10	Washer, Front Bearing	42	Spacer, Motor
11	Leadscrew	43	Spacer, Gear, Motor Side
12	Bumper, Rear	44	Bearing, Idler
13	Drive Nut	45	Shaft, Idler Gear
14	Bushing, Leadscrew	46	Gear, Idler, 1st Stage
15	Drive Housing	47	Spring, Wave
16	Gasket, Drive Housing	48	Spacer, Gear, Non-motor Side
17	Screw, Guide Cylinder, Upper, Rear	49	Gear, Idler, 2nd Stage
18	Screw, Cover Plate	50	Label, IDC Serial Tag
19	Guide Flange Body	51	Plate, Cover, Main
20	Guide Flange Bushings	52	Label, IDC Decal
21	Magnet, Limit Switch	53	Screw, Guide Cylinder, Lower, Rear
22	Screw, Set	54	Cover, Motor shaft
23	Lube fitting	55	Screws, Cover, Motor shaft
24	Thrust Tube	56	Plate, Cover, Upper
25	Rod End	57	Quick Disconnect
26	Guide Cylinder	58	Coupling, Drive
27	Breather	59	Sleeve, Coupling
28	Plug, Lube	60	Spacer, Bumper
29	Bumper, Front	61	Spacer, Thrust Tube
30	Rod End Housing	62	Shield, Pinion
31	Bearing, Rod End	63	Spacer, Quick Disconnect
32	Wiper, Rod End		

Exploded Parts Diagram - EC2/EC3 Parallel Motor Mounting



Exploded Parts Diagram - EC2/EC3 Parallel Motor Mounting



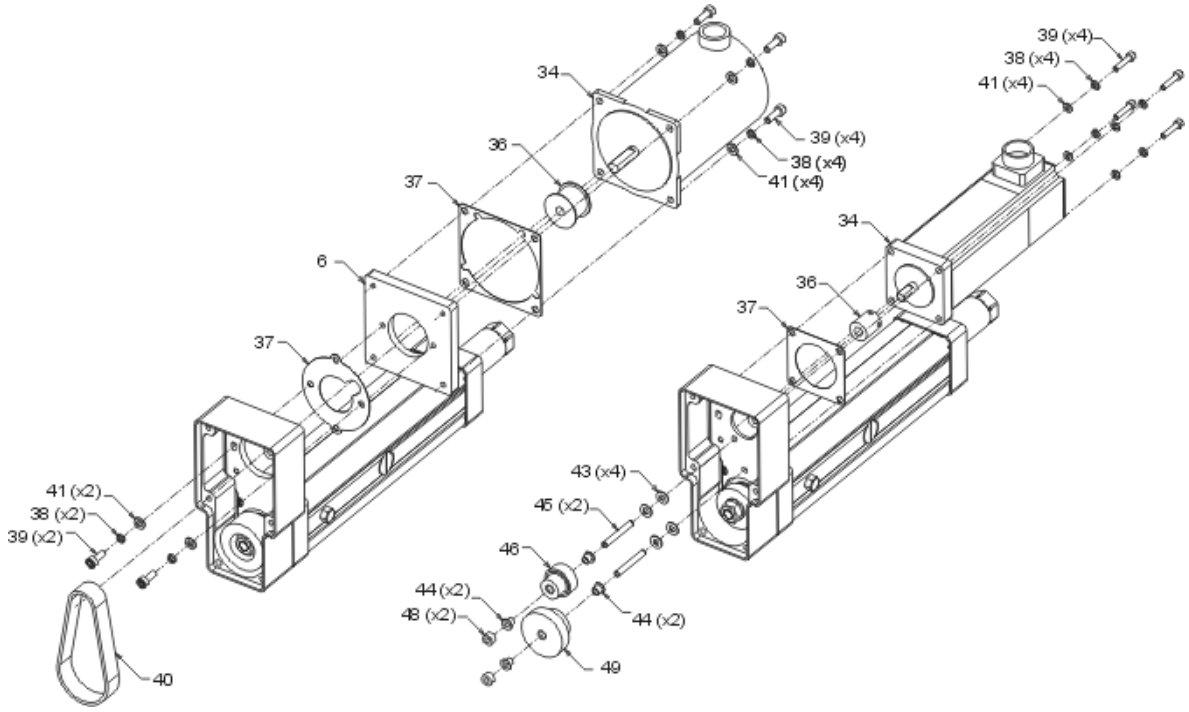
Exploded Parts Diagram - EC2/EC3 Parallel Mounting

S32 Motor

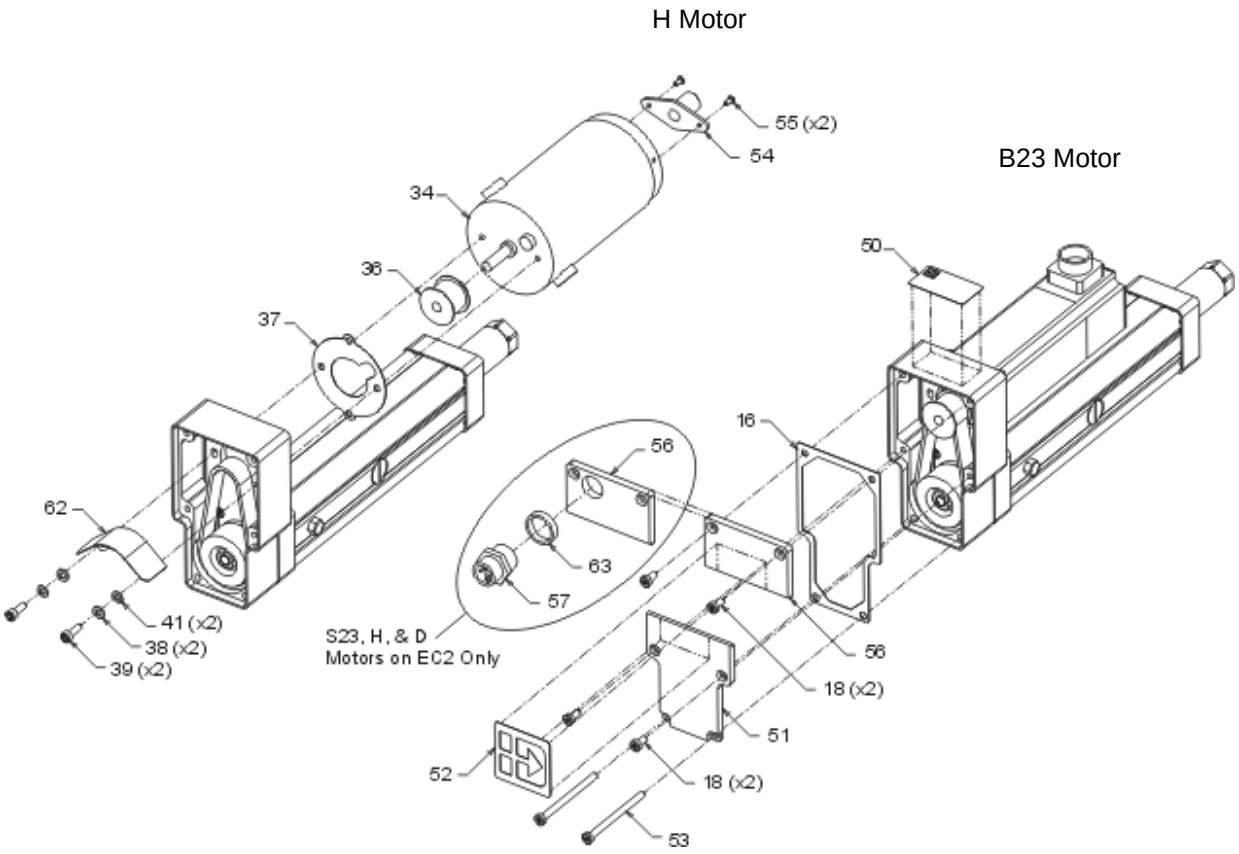
1:1, 1.5:1, 2:1
Drive Ratios

B23 Motor

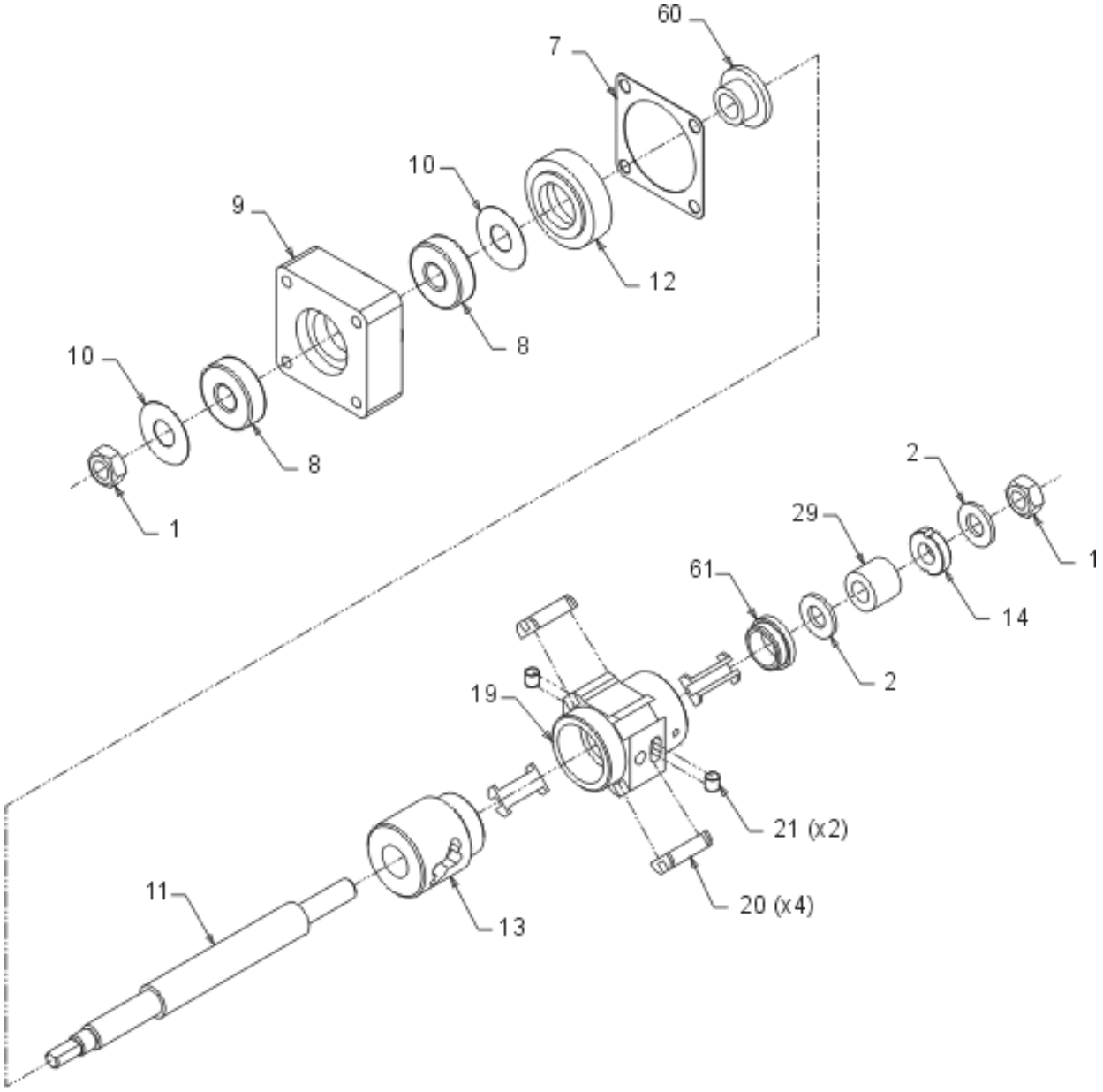
5:1, 10:1
Drive Ratios



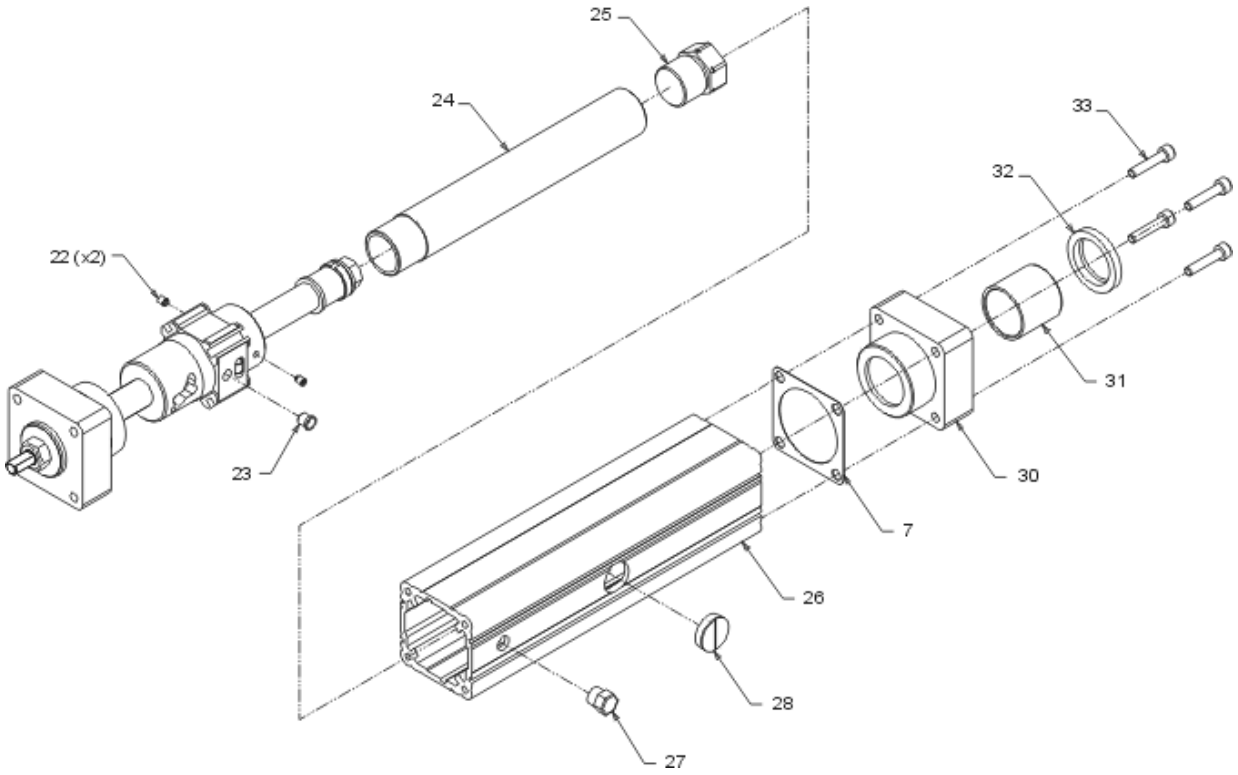
Exploded Parts Diagram - EC2/EC3 Parallel Motor Mounting



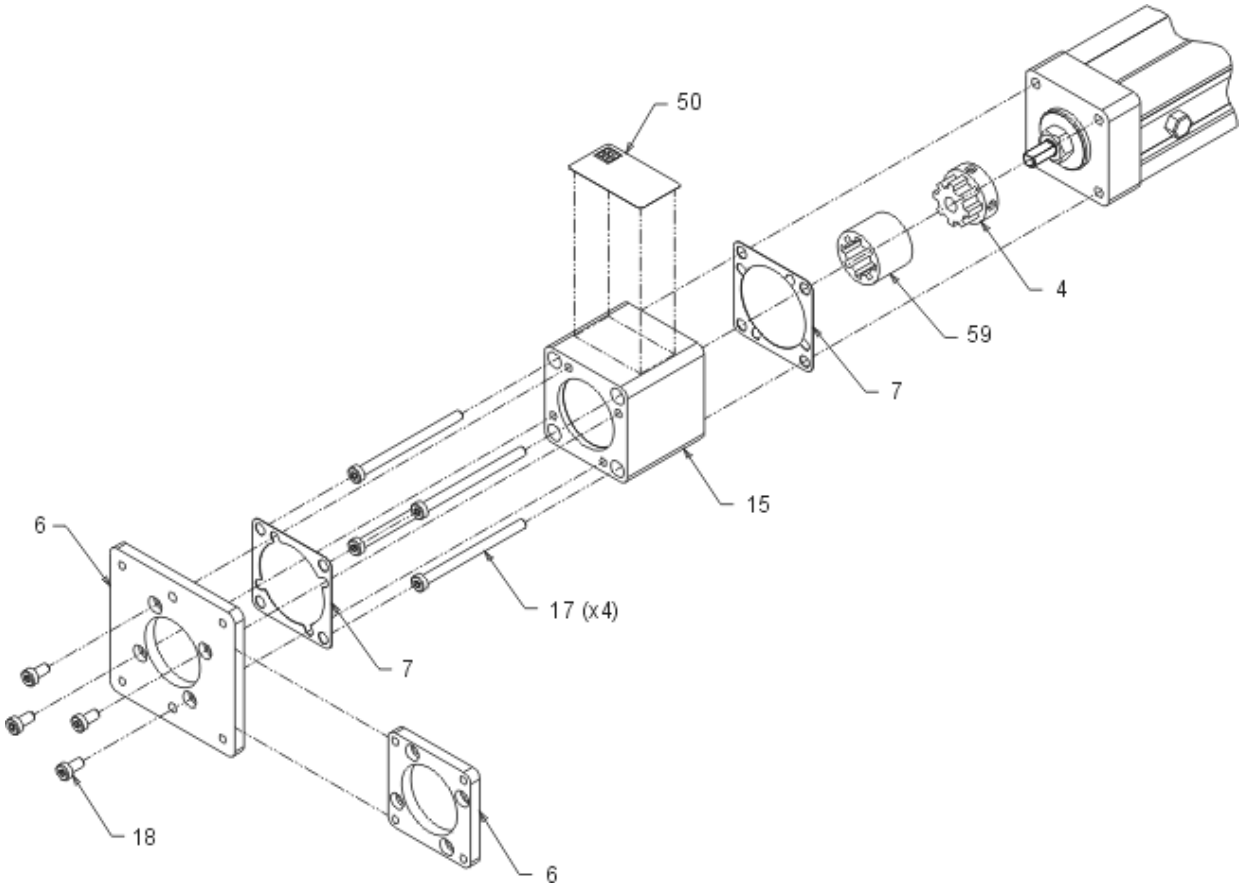
Exploded Parts Diagram - EC2/EC3 Inline Motor Mounting



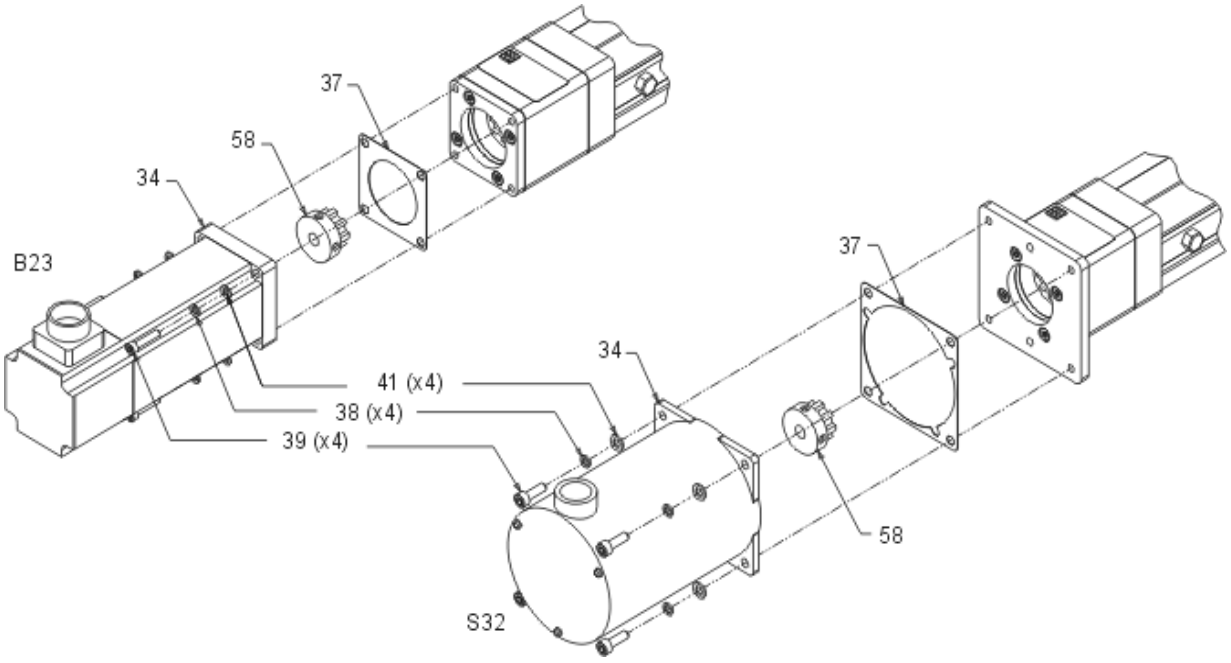
Exploded Parts Diagram - EC2/EC3 Inline Motor Mounting



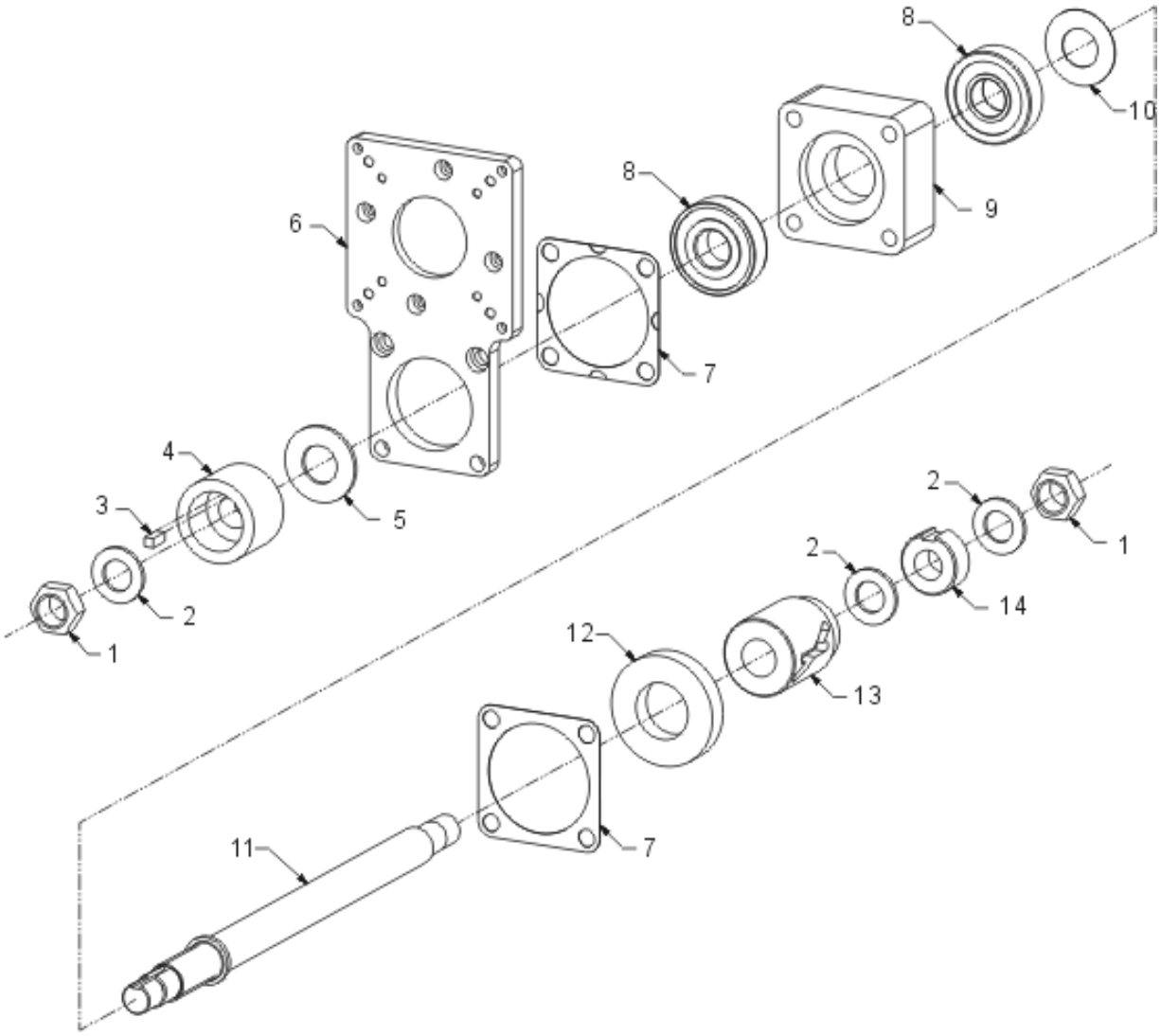
Exploded Parts Diagram - EC2/EC3 Inline Motor Mounting



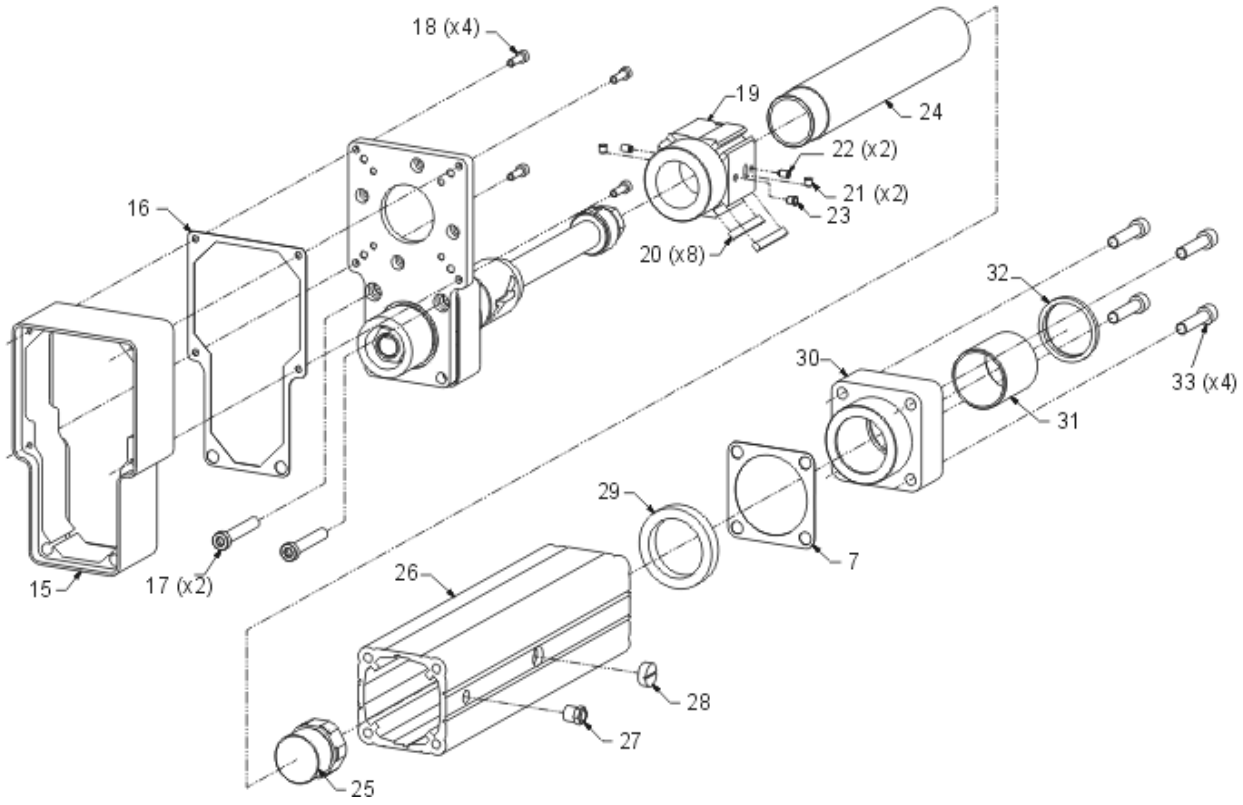
Exploded Parts Diagram - EC2/EC3 Inline Motor Mounting



Exploded Parts Diagram - EC4/EC5 Parallel Motor Mounting



Exploded Parts Diagram - EC4/EC5 Parallel Motor Mounting



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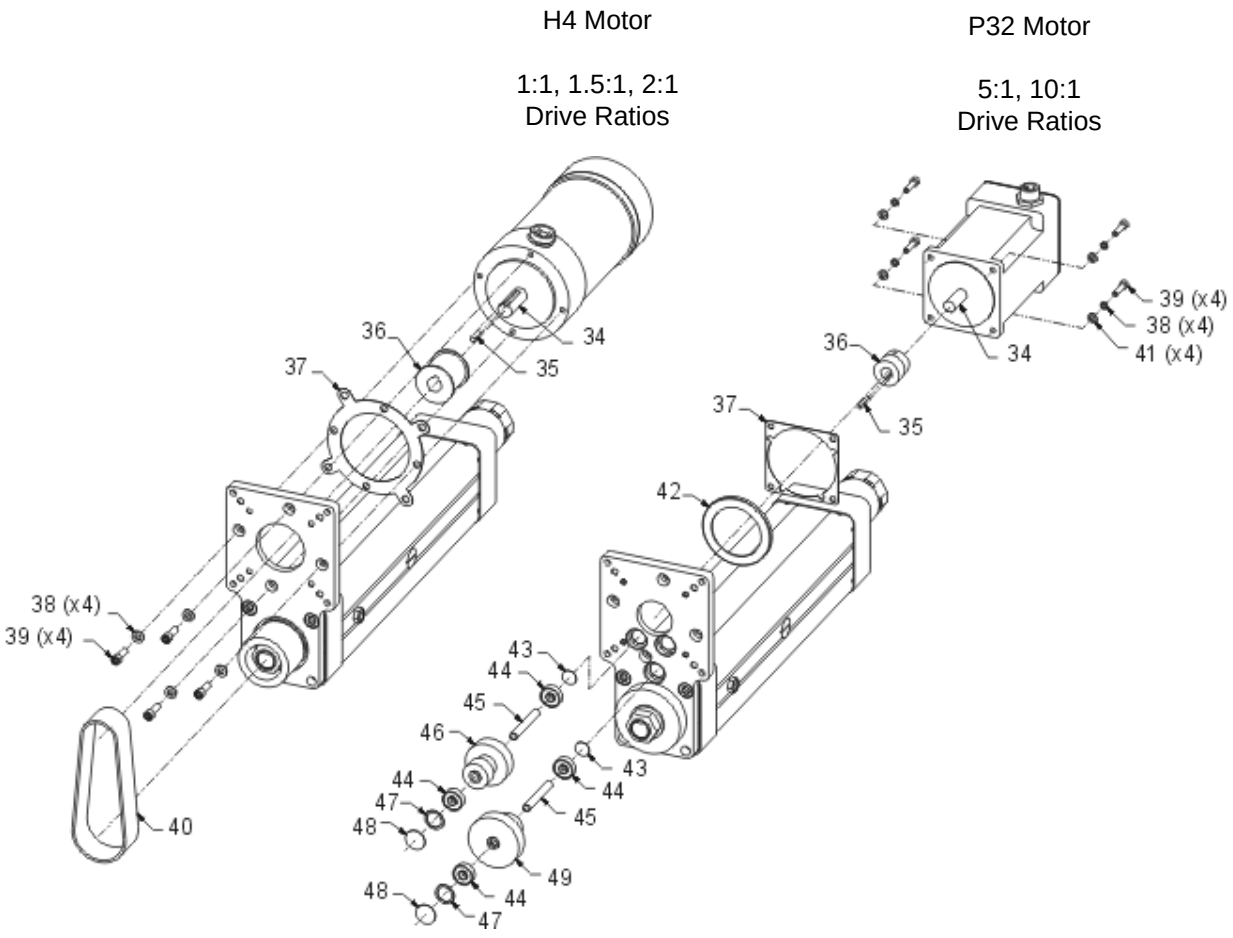
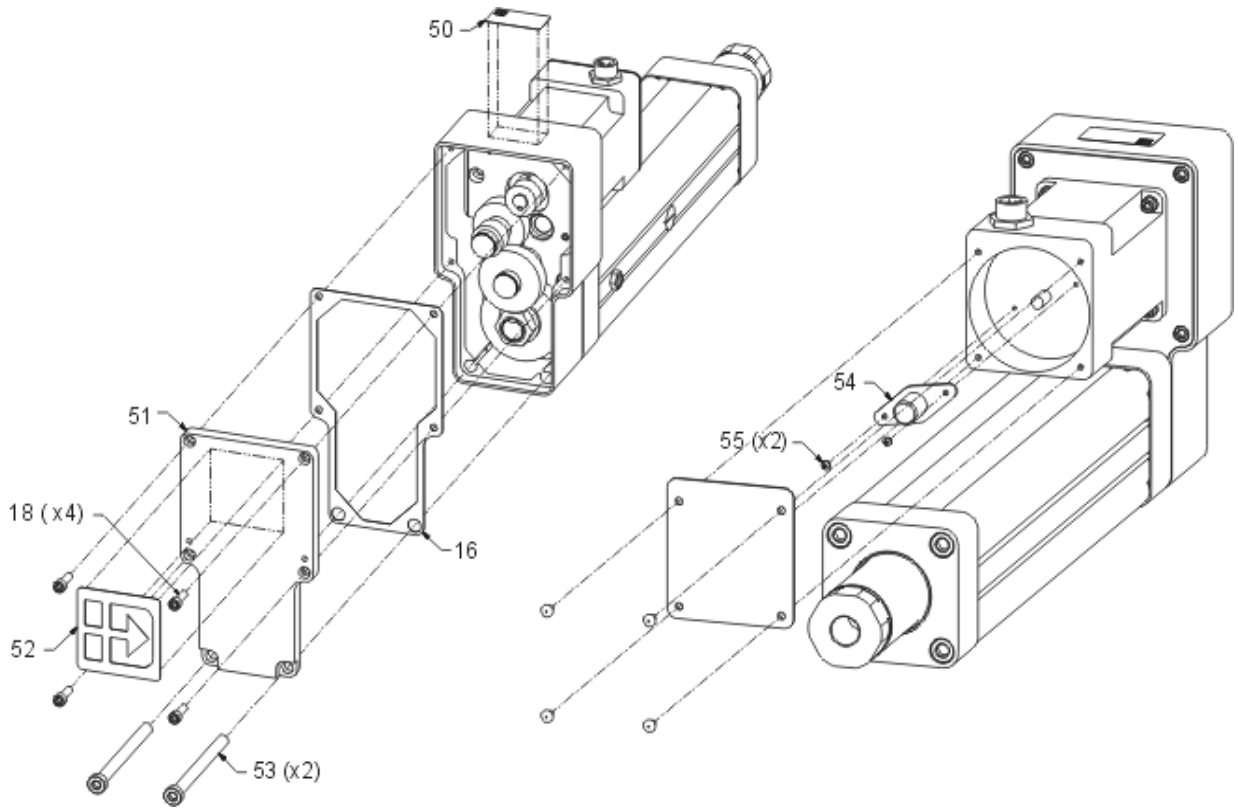


Exploded Parts Diagram - EC4/EC5 Parallel Motor Mounting



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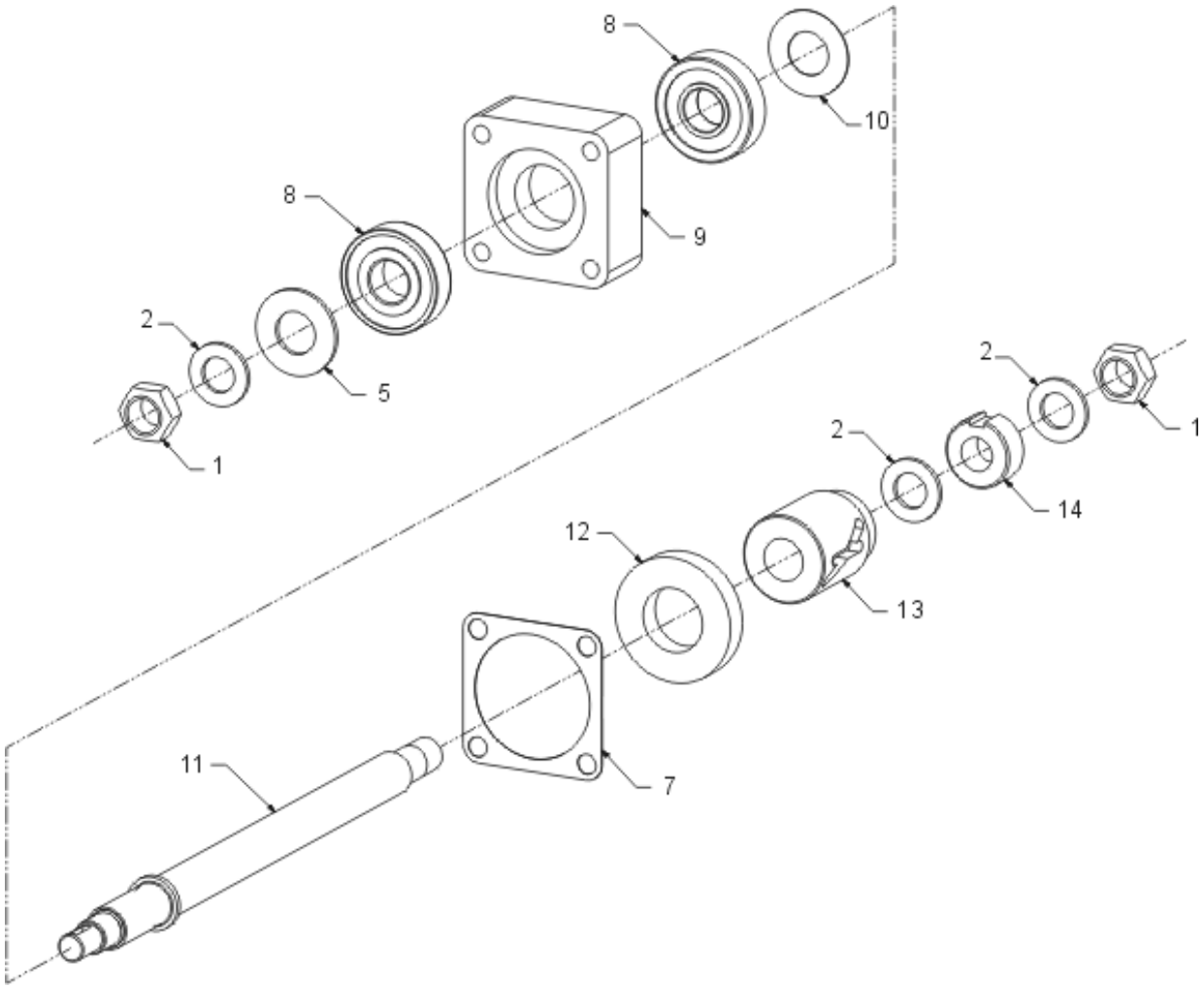
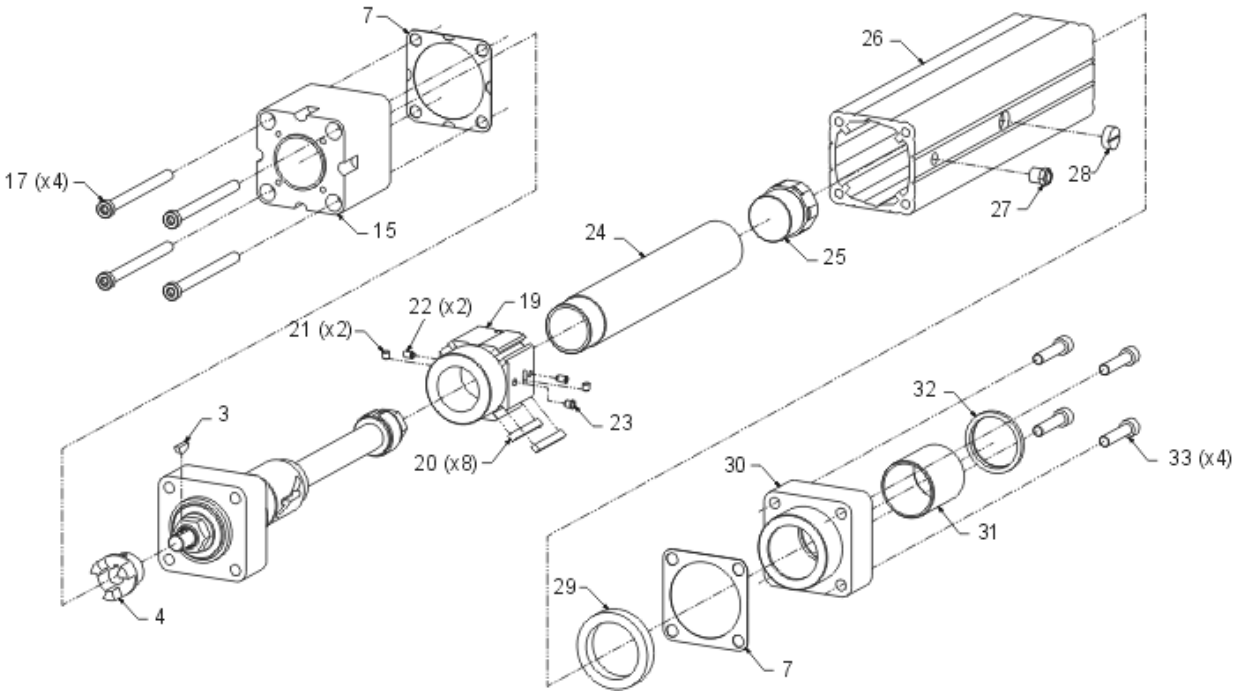
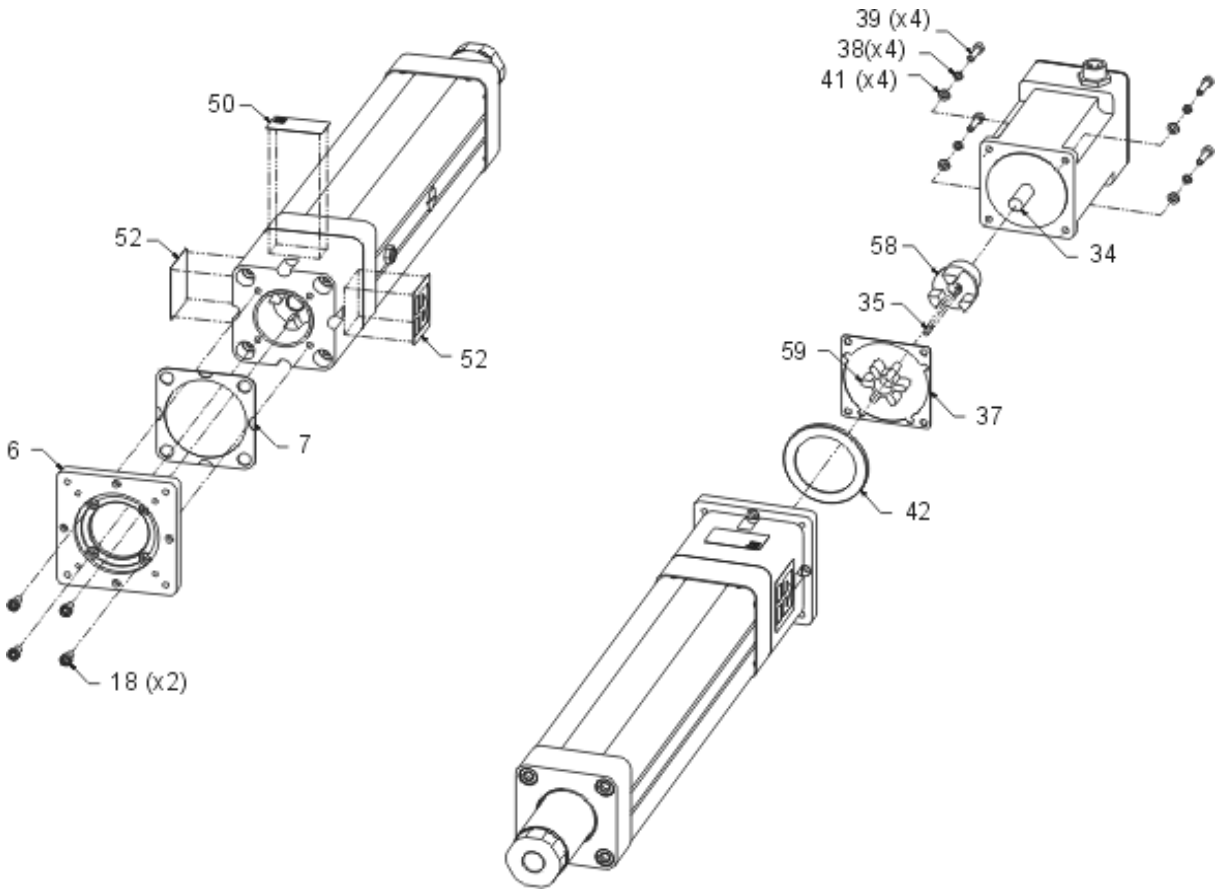


Exploded Parts Diagram - EC4/EC5 Inline Motor Mounting



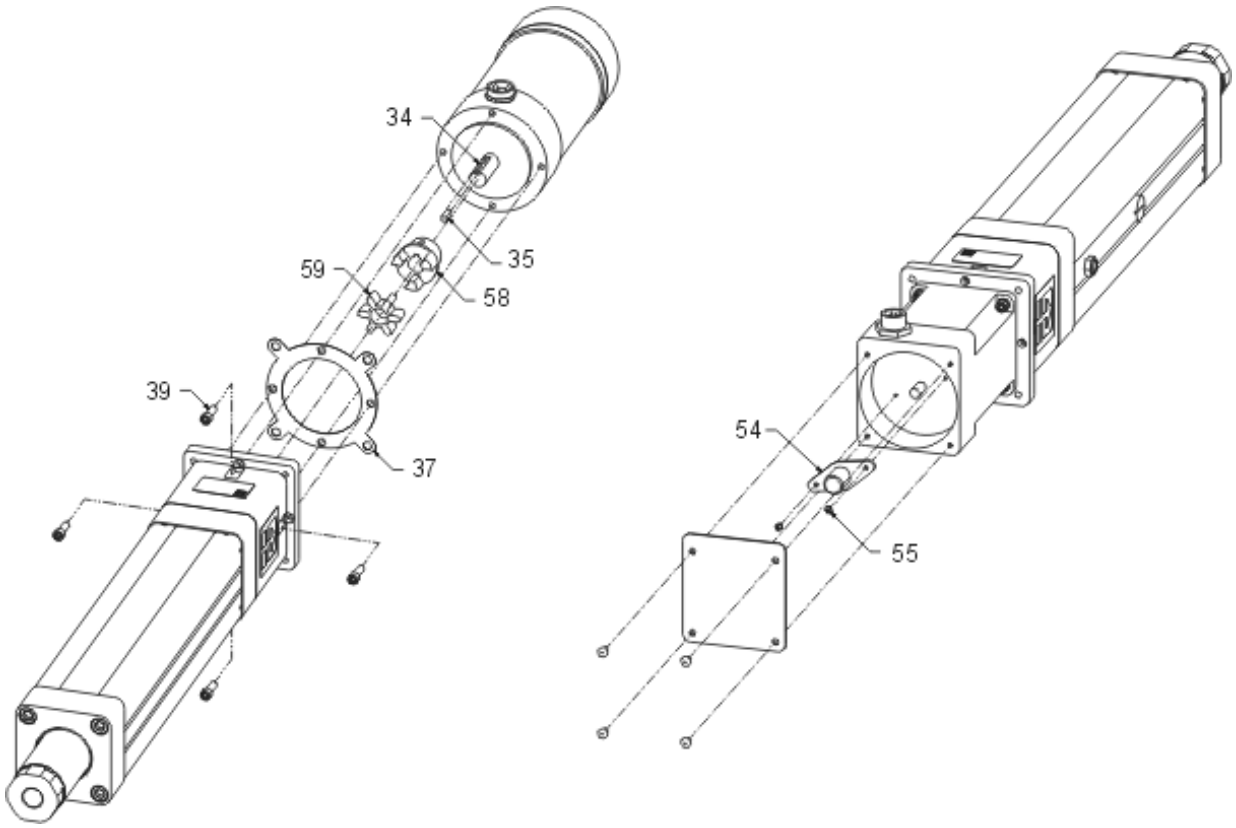
Exploded Parts Diagram - EC4/EC5 Inline Motor Mounting

P32 Motor



Exploded Parts Diagram - EC4/EC5 Inline Motor Mounting

H4 Motor



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11. Warranty and Service Coverage

Industrial Devices Corporation warrants all EC Cylinders to be free of defects in material & workmanship for a period of one year from the date of shipment to the user. Products returned prepaid to the factory will be repaired or replaced at our option at no charge, and returned prepaid to the user.

Products that fail due to improper use or misapplication are not subject to the terms of this warranty.

Technical Support

Industrial Devices offers technical support through its factory authorized and trained Distributors, and through its factory-based Applications Engineering and Inside Sales department.

If an application problem exists or if the product has failed, contact your Distributor or Industrial Devices for technical assistance. Contact our factory at 1-800-747-0064, outside the U.S. at 707-789-1000.

Factory Repair Service

Product repairs are performed at our factory in Petaluma, California. Prior approval by Industrial Devices is required before returning a product for any reason. All returned products must be accompanied by an Industrial Devices supplied RMA (Return Material Authorization) number.

In Case of Failure

1. Get the Model and Serial Number of the defective unit, and document the nature of the failure using the RMA Data Form to help us repair the unit.

2. Contact your IDC Distributor or Industrial Devices Corporation (at 1-800-747-0064) for an RMA#.

3. Prepare a purchase order for the repair cost in case the unit is out of warranty.

4. Ship the unit prepaid, with the RMA number and documentation to:

Industrial Devices Corp., LLC
3925 Cypress Drive
Petaluma, CA 94954
Attn.: RMA # _____

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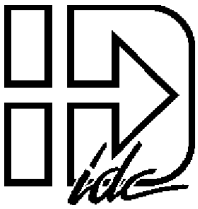

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